OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

FEBRUARY 5, 1951
VOLUME 40, No. 3

AMERICAN DYESTUFF REPORTER

DEVOTED TO TEXTILE CHEMISTRY • BLEACHING • DYEING • PRINTING • FINISHING

Cotton and Rayon White Goods Get their Sales Appeal in the MILL!

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Experienced mill men know that white goods with the ultimate in sales appeal are produced consistently, day in and day out, with Tinopal BVA* — made specifically for mill application. Tinopal BVA produces whiter whites and with better wash fastness, too.

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Profine

FACTS ABOUT PROFINE

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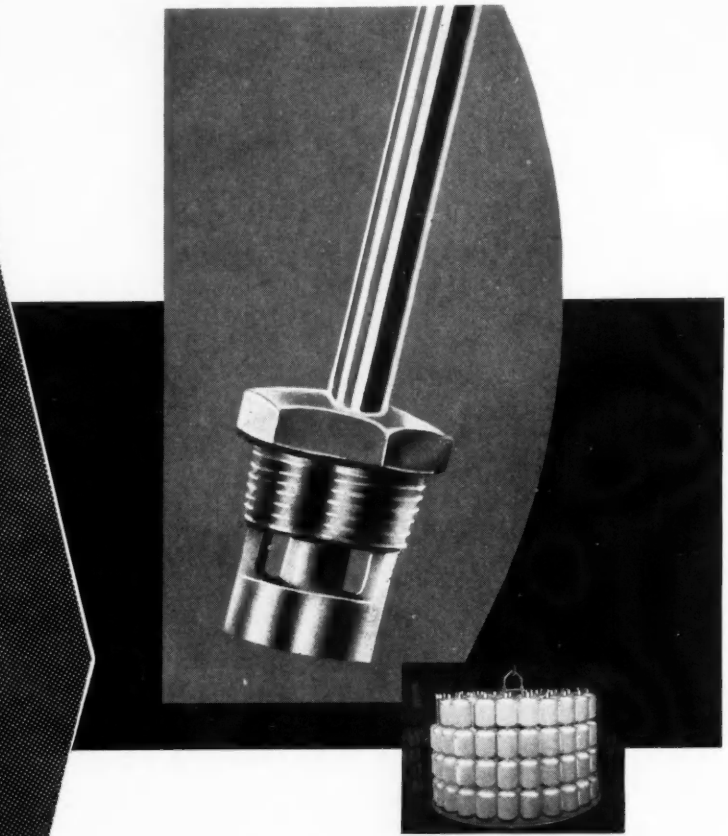

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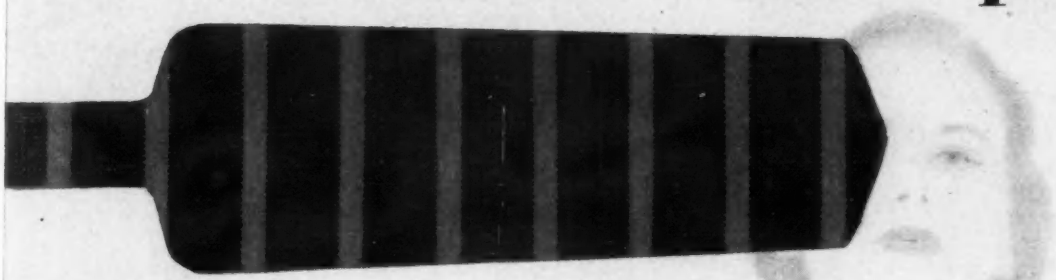

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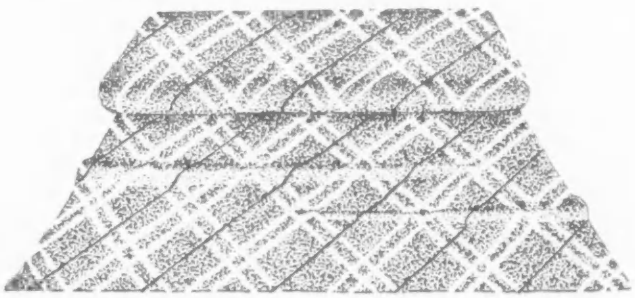

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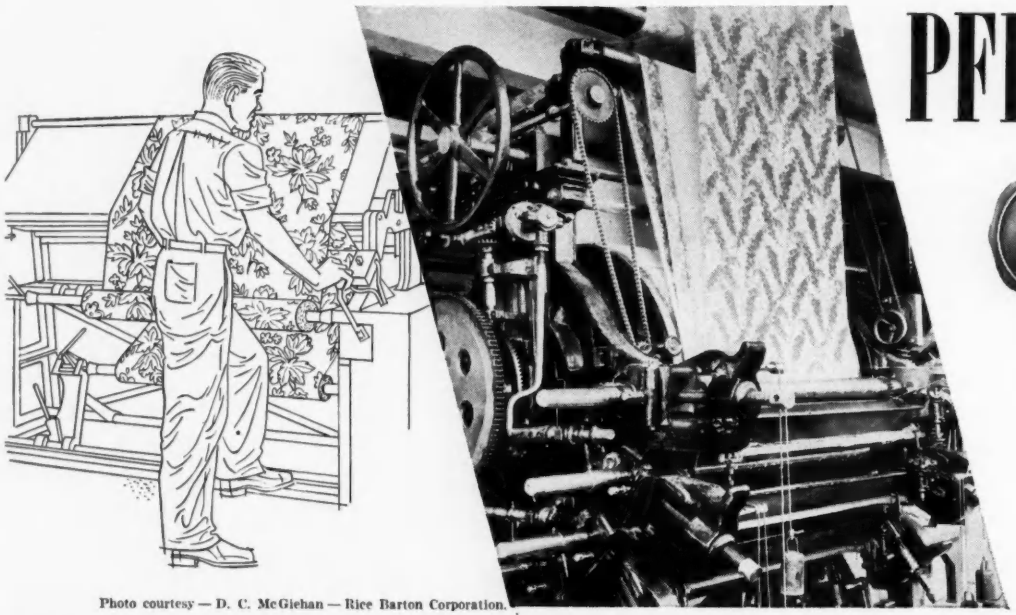

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get **More rapid rinsing, cleaner shades, less crocking.**

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SODIUM SULFIDE—Na_2S

Mol. Wt. 78.1

M.P. . . . . 100° C

Light buff colored solid in flake form. Rapidly soluble in water; slightly soluble in alcohol; insoluble in ether. Also available in solid form.

ANALYSIS

Na_2S	60 to 62%
NaCl	1.5% Max.
Other Na Salts	2.0% Max.
Fe	8 ppm Max.
Cu, Ni, Cr, Mn, Pb	1 ppm Max.
Water of crystallization	35% Min.

USES

In manufacture of dyestuffs, chemical intermediates, straw and kraft pulp, rubber, as an ingredient of dye liquor for textile dyeing; boiling out linen; ore flotation and metal refining; in unhairing hides and wool pulling; desulfurizing viscose rayon.

SHIPPING CONTAINERS

Flake: Steel drums	90 & 350 lbs. net
Solid: Steel drums	625 lbs. net

SODIUM SULFHYDRATE—NaSH

(sodium hydrosulfide)

Mol. Wt 56.1

M.P. . . . . 55° C

Light lemon colored solid in flake form. Completely and rapidly soluble in water, alcohol and ether.

ANALYSIS

NaSH	70 to 72%
Na_2S	2.5% Max.
NaCl	0.8% Max.
Na_2SO_3 and $NaHCO_3$	0.4% Max.
Fe	5 ppm Max.
Cu, Ni, Cr, Mn, Pb	1 ppm Max.
Water of crystallization	28 to 26%

USES

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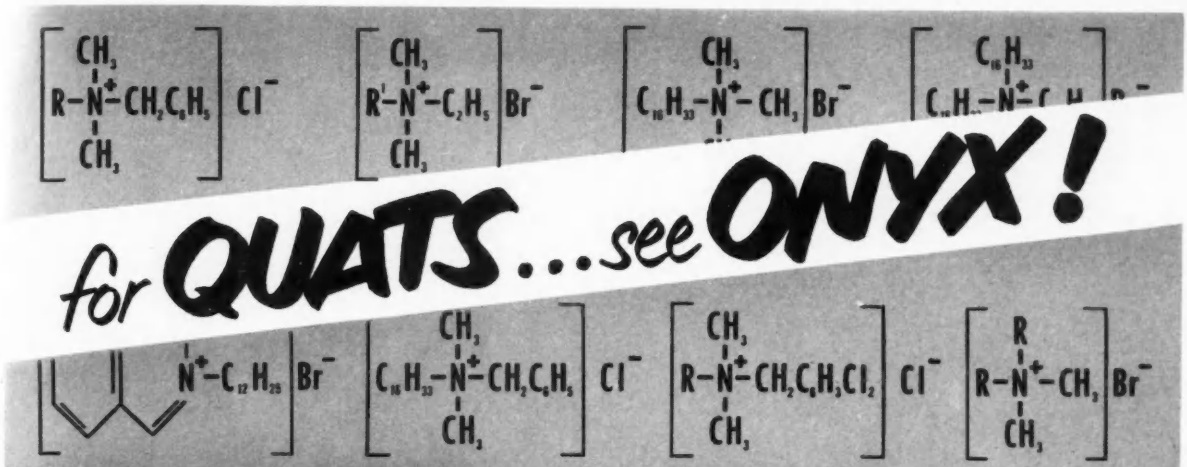

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Onyx has been a leading factor in the production of quaternary ammonium compounds since the days when these cationic germicides were first commercially used. Today we produce a greater number of these compounds than any other manufacturer.

Some of the quaternaries we make are of interest to research laboratories and development departments searching for specific germicidal, algaecidal and fungicidal or deodorizing action. Others are available in virtually unlimited quantities, and have wide industrial application. Here are some of the latter group:

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Alkyl dimethyl benzyl ammonium chloride. The most widely used cationic germicide at the present time. Sold in 50% aqueous solution to disinfectant and germicide manufacturers for dilution and/or incorporation in their own products. The safest and most effective bactericide and bacteriostatic agent available today. Also acts as a powerful deodorant.

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Alkenyl dimethyl ethyl ammonium bromide. Sold as a 75% concentrate in isopropanol or propylene glycol. Onyxide is the most effective algaecide now available. It is in very wide use for the control of algae in swimming pools, cooling water, air-conditioning systems and similar applications.

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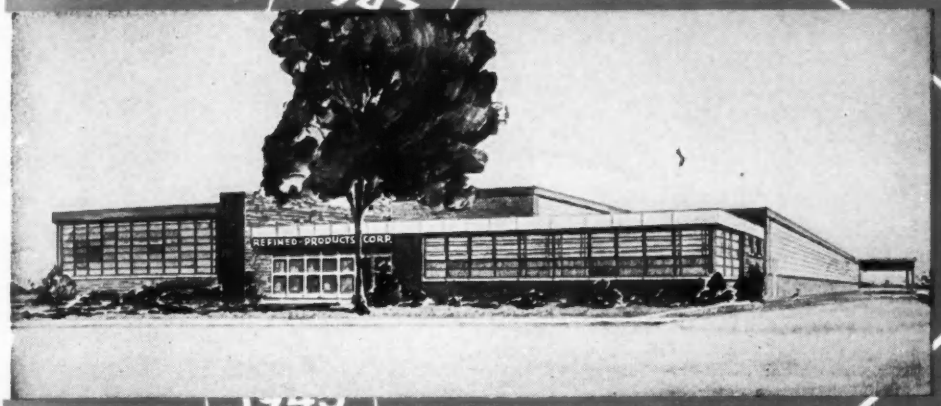

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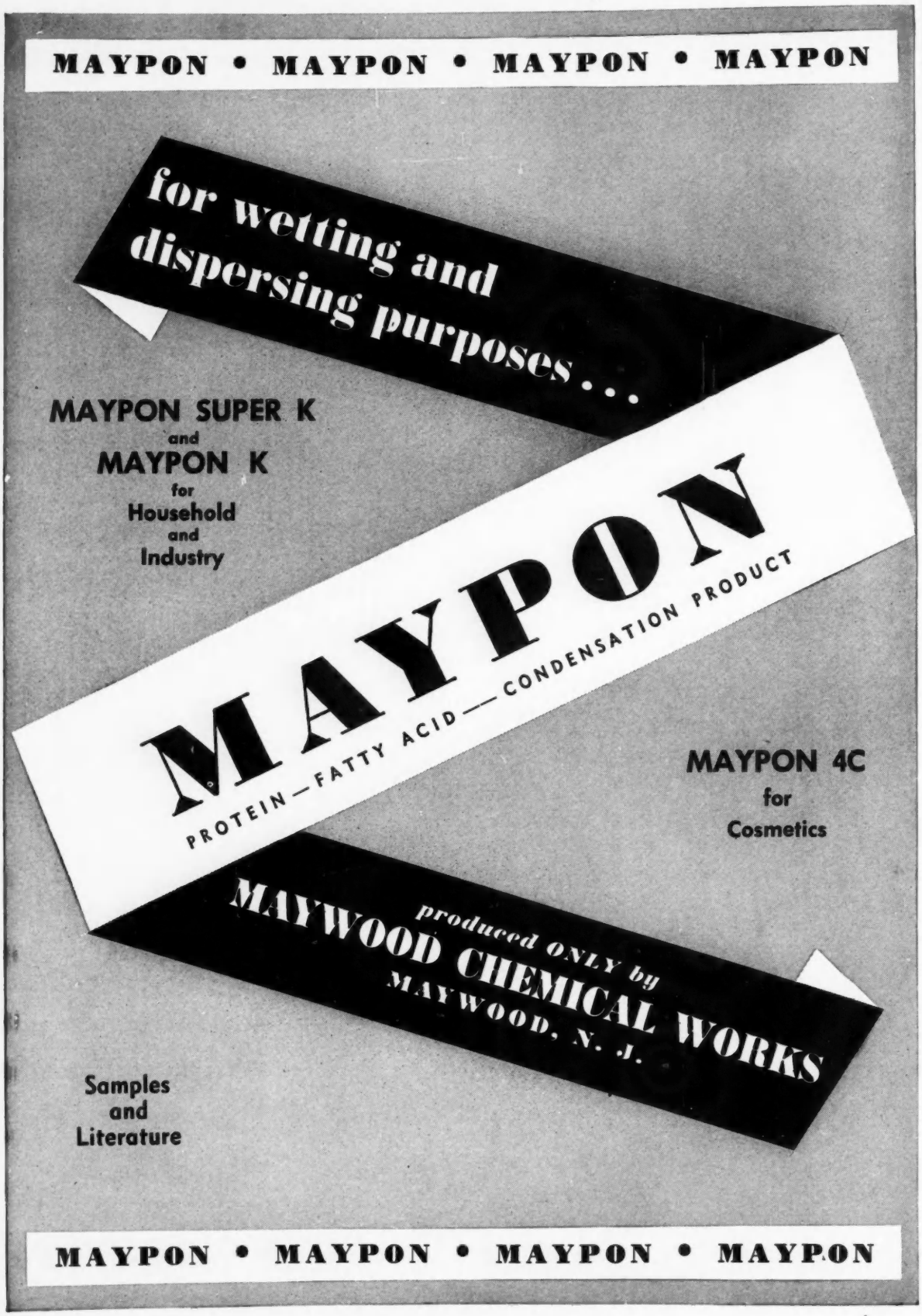
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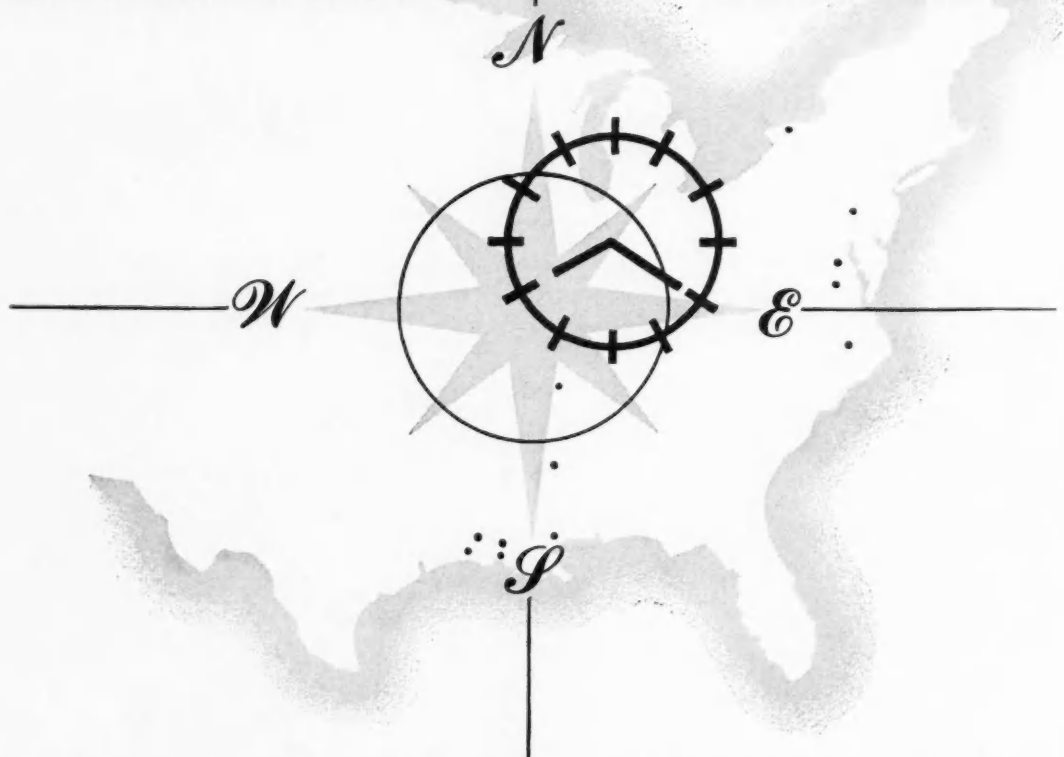

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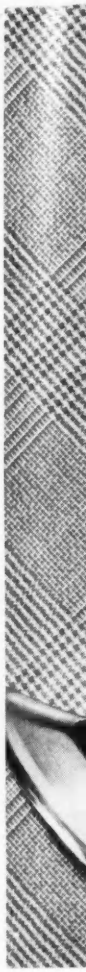

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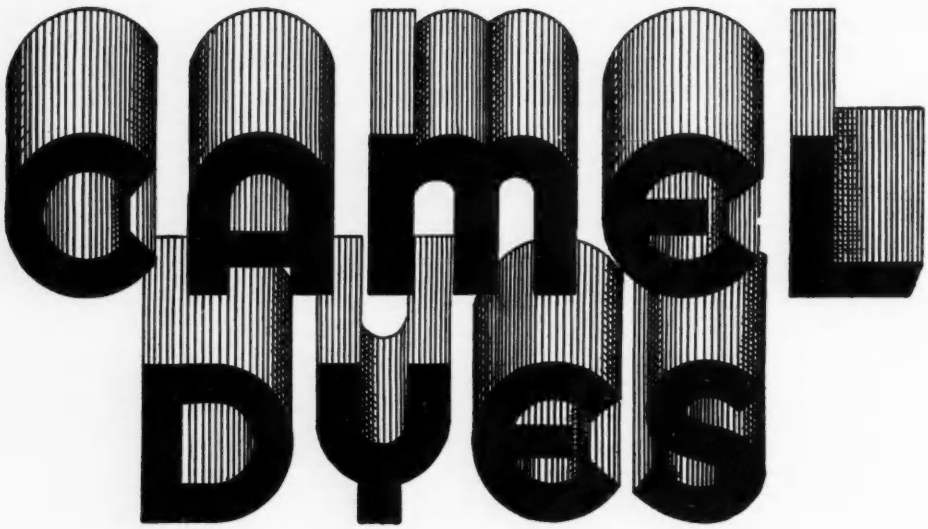

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Titer	—	5° C
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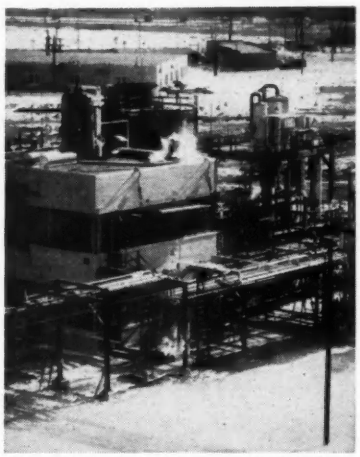
Acid Value	195	201
Saponification Value	195	201
Unsaponifiable	—	2%
Color (Lovibond 5¼" tubes)	—	1.5R - 15Y



Crystallization Unit at Armour's McCook Plant

Distilled Red Oil
(Low Titer)

	Min.	Max.
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Iodine No. (Wijs)	90	95
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Saponification Value	193	200
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Arquad 2HT is compatible with certain finishing agents such as starches, dextrins, glue and gelatin. It can also be applied with most urea-formaldehyde and melamine-formaldehyde resin finishes including the new acid colloid resins.

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Armour Chemical Division adds industrial oils to line

The Armour Chemical Division announced recently that it had taken over the supervision and sales of the Armour Industrial Oils Department. This move will greatly improve customer service by making available the facilities of Armour's Research Laboratory and the services of specially trained representatives to discuss customers' problems.

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Specifications	Prime Lard Oil	Extra Winter Strained	No. 1 Lard Oil
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N.P.A. Color	2 Max.	2½ Max.	5 Max.
Saponification Number	194-200	194-200	194-200
Iodine Number (Wijs)	70-75	70-75	70-75
SP. GR. 60°/60°F.	0.910 - 0.920	0.910 - 0.920	0.910 - 0.920
Viscosity (S.U. 100°F.)	190 - 210	190 - 210	190 - 210

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FEBRUARY 5, 1951
VOLUME 40 NUMBER 3

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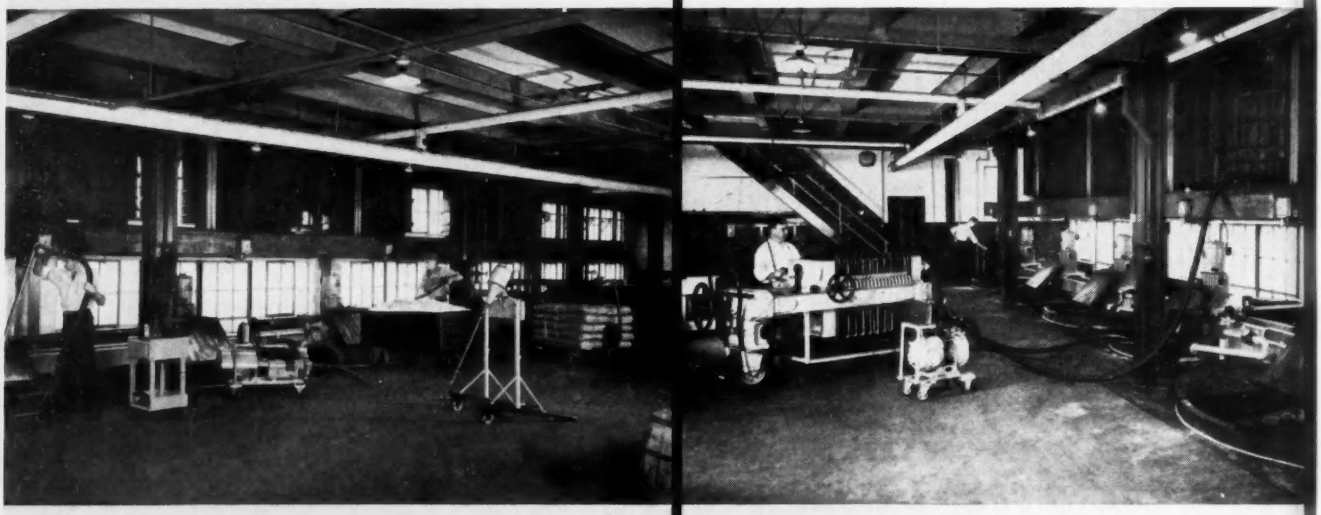

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Proceedings of the
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FEBRUARY 5, 1951

Philadelphia Textile Institute Student Chapter

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

51-1

Education: Penna. State College, B.S. Chem. Engg.

Experience: Chemist, dyer and textile printer, executive.

Age 42; married; references; east coast preferred.

1-22, 2-5

51-2

Education: Textile school.

Experience: bleacher, dyer, executive.

Age 68; married; references; retired but in good health; position on east coast desired.

1-22, 2-5

Two Sections Change Meeting Dates

THE date of the meeting of the New York Section, originally scheduled for February 23rd at the Hotel New Yorker, has been changed to March 9th at the same location.

The March meeting of the Rhode Island Section has been changed from the 23rd to the 30th. The site, Providence Engineering Society, remains the same.

Membership Applications

SENIOR

Raymond J Andres — Research Supervisors, E I duPont de Nemours & Co, Inc, Newport, Del. Sponsor: C K Black.

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Robert G Butler—Owner, Dyecraft, Los Angeles, Calif. Sponsors: D F Driscoll, J M DeLaBarre.

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Pierre Lamarche—Chemist, Manufacturas del Centro, Huancayo, Peru. Sponsors: C Z Draves, H E Hager.

Harvey A Lamoureux—Head Colorist, Windsor Print Works, North Adams, Mass. Sponsors: F C Hewitt, H Gendreau.

Technical Program Committee Membership Completed

WILLIAM A HOLST, National Aniline Division, Allied Chemical & Dye Corp, Chairman of the Technical Program Committee for the 1951 Convention has announced that committee membership has been completed. Those interested in presenting papers at the technical sessions should address him at 40 Rector Street, New York.

Members of Mr Holst's committee are: Charles H A Schmitt, Sandoz Chemical Works Inc; E A Leonard, Alexander Smith & Sons Carpet Co; Paul Choquette, General Dyestuff Corporation; Henry E Millson, Calco Chemical Division, American Cyanamid Company; Francis S Richardson, Waldrich Company, Delawanna, N J; Weldon G. Helmus, Fair Lawn Finishing Company, Fair Lawn, N J; and P J Wood, Royce Chemical Company, Carlton Hill, N J.

Henry L Young of Interchemical Corporation, Textile Colors Division, chairman of the exhibits committee, reports that 54 firms have already reserved 81 of the 125 booths, indicating the largest exhibit ever held by the Association. Campbell-Fairbanks Inc, exposition managers, has been retained to direct the exhibit program.

—♦ ♦—

Philadelphia Section Dates

THE Philadelphia Section has announced the following meeting dates for 1951:

January 19
March 16
April 13
September 14
October 26
December 7

All meetings will be held at Kugler's Restaurant in Philadelphia, Pa.

The first 1952 meeting will also be held at Kugler's on January 18.

The annual outing for 1951 will be held at the Torresdale-Frankford Country Club on June 1.

Wool Group—

DYEING OF WOOL WITH VAT COLORS WITH PARTICULAR EMPHASIS ON THE ANTHRAQUINONE TYPES*

ARTHUR E WEBER

National Aniline Division, Allied Chemical and Dye Corporation

It has been found that, by carefully observing a number of critical features, which are collectively responsible for the success of the dyeing process, practically all of the anthraquinone vat colors can be dyed on wool in light, medium and dark shades including black, without undue adverse effect on the tensile strength, elasticity and hand of the fiber. For the same reason as in the dyeing of cotton, rayon and silk, both anthraquinone and indigoid types are needed for coloring wool in a complete range of shades of maximum brilliancy and fastness properties.

Vat colors have very good affinity for wool. While they exhaust somewhat more slowly than on cotton, they build up to a greater depth. As a class they have good level-dyeing properties and are less selective than the acid and chrome colors with regard to dyeing tippy wool or mixed stocks.

Vat colors properly applied to wool and other animal hairs are faster than any other class of dyestuff currently in use, and produce considerably brighter shades than do the chrome dyes and metalized acid colors. A careful selection of vat colors applied to wool under favorable conditions permits the development of a full range of shades of a Fade-Ometer rating at least equal to AATCC Standard #6, even in light shades, and of excellent fastness to all wet-processing operations, including peroxide bleaching and cross-dyeing in a boiling sulfuric acid bath. With few exceptions, these shades are fast to an alkaline chlorination treatment, such as the Harriset process.

INTRODUCTION

THE object of this paper is to render a report on our study of the conditions that make it possible to dye vat colors, particularly of the anthraquinone series, in full shades on wool, with brilliancy, strength and fastness properties comparable to those obtained in the dyeing of cotton, and without undue adverse effect on the tensile strength, elasticity and hand of the fiber.

Many references can be found with regard to the dyeing of indigoid and thioindigoid vat colors on wool. As far as the dyeing of anthraquinone vat colors is concerned, previous literature, as a whole, has been derogatory.

It has been found that by control of several conditions, which are collectively responsible for the success of the dyeing process, most of the anthraquinone vat colors can be dyed on wool in light, medium and full shades, including black. Our efforts, which date back a number of years, have enabled us to secure U S Patent 2,508,203 covering definite phases of the dyeing of anthraquinone vats on wool and other animal hairs.

While in our paper we shall discuss primarily the application of the anthraquinone vats, we are fully aware of the outstanding properties of some of the members of the indigoid line, particularly in the range of bright reds and dark blues. Both color classes are needed to obtain a complete range of shades of maximum brilliancy and fastness properties on wool.

PRELIMINARY DISCUSSION

Before entering into a description of the process, I shall discuss the function of the chemicals that enter into it. The three chemicals of primary importance used in our process for dyeing anthraquinone vats are sodium hydroxide, sodium hydrosulfite and common salt. The use of a strong alkali is mandatory for keeping the leuco compounds of most anthraquinone vat colors in solution, a condition that must be fulfilled if proper dyeing is to take place. Our tests indicate that any alkali which in aqueous solution produces a pH of between 12 and 13 may be used along with hydrosulfite and salt to produce satisfactory dyeings. However, for reasons of economy, it appears at this time that caustic soda is the only alkali of interest for practical use.

The quantity of caustic soda required for dyeing is determined primarily by the amount needed to keep the dyestuff in proper solution throughout the entire dyeing operation. This in turn depends mainly on the following four factors:

1. *The Type of Dyestuff*—Those anthraquinone vat colors which, on cotton, are dyed in a strongly alkaline bath and are often called IN dyestuffs have the greatest tendency to precipitate because of crystallization, hydrolysis or possibly other reasons. They require more caustic soda to be kept in solution than do the more readily soluble IK and IW colors.

2. *The Amount of Dyestuff*—The leuco vats, being phenolic compounds, are acidic in nature. The amount of caustic soda needed, therefore, increases with increasing amounts of dyestuff.

3. *The Ratio of Dye Liquor to Material*—The quantity of caustic soda required increases with the length of the dyebath, but by no means in direct proportion to the increase in the volume of dye liquor.

4. *Condition (pH) of the Wool Being Dyed*—Scoured raw wool or worsted top is usually received in a distinctly alkaline condition, with a pH of between 9 and 10. Chlorinated top usually contains residual acid, the amount of which may be determined by titrating 10 grams of material, suspended in 400 ml of distilled water at 90° F, with a 1% solution of caustic soda. Chlorinated tops from various sources, which were tested by us, were found to need between 0.3% and 1.5% more caustic soda than regular top.

The second chemical of major importance is the sodium hydrosulfite, which reduces the vat color to its leuco form and maintains it in this state during the entire dyeing operation. It is preferable to use an excess of hydrosulfite, inasmuch as this contributes toward the protection of the wool from deterioration, and, in some instances, increases the rate of exhaustion.

The third chemical of prime importance in the dyeing of anthraquinone vat colors

* Presented before Twenty-ninth Annual Convention in Portsmouth, N H, on Sept 29, 1950.

on wool is salt. Any good grade of common salt, as well as sodium sulfate, seems to be suitable. There are three items that tend to accelerate the exhaustion of the average anthraquinone vat color on wool: namely, increased temperature, increased alkalinity and use of substantial amounts of salt. It is obvious that of these the use of salt does not tend to cause damage to the fiber, and therefore the fullest possible application should be made of it. Salt not only aids in the exhaustion of the dyestuff, but appears to contribute markedly to the maintenance of the tensile strength of the dyed fiber. In the dyeing of wool, we therefore suggest the addition of salt for all the anthraquinone vat dyestuffs. To derive the fullest possible benefits from the salt, the entire amount of it is normally added before the start of dyeing. Its quantity is determined by the depth of shade and the type of dyestuff used.

In addition to caustic soda, hydrosulfite and salt, the functions of which have been described in some detail, occasional use is made of the following auxiliary chemicals:

1. A water softener, such as adjusted Calgon, the amount being dependent on the hardness of the water.

3. A wetting agent that has good stability in alkaline salt solution. Use of 1%-2% of Tergitol #4 gave the desired results.

3. Small quantities of a good grade of sulfonated oil are added to the stock vat.

4. In most cases a protective colloid, such as glue or sodium lignin sulfonate, in amounts up to 2% is added. Glue is somewhat superior to lignin sulfonate with regard to equalizing shade differences between various types of wool, and with respect to reducing tippiness. On the other hand, glue tends to cause foaming of the dyebath and may hold back appreciable amounts of dyestuff in the liquor.

EXPERIMENTAL DETAILS

The bulk of our experimental work was done on worsted top, which was wound by hand on perforated spindles of 1⅜-inch diameter and held in place between 2 plates of 5½-inch diameter. The upper plate was adjustable and permitted compression of the top to any degree desired. The spindles fit into an enclosed one-pound experimental Gaston County machine of standard stainless-steel construction, which was used for most of these experiments. The kier of the machine has a volume of 5½ liters, the expansion tank a capacity of 2½ liters. By using spindles up to 7½" in length, and winding between 8 oz and 24 oz of top more or less tightly, we were able to work in any desired liquor ratio between 10:1 and 30:1. In the case of raw stock, which was packed in baskets, bath ratios between 15:1 and 30:1 were used. Woolen and worsted yarns were dyed in packages weighing between 12 and 16 oz.

In the dyeing of top, one-way flow only was used, since many top-dyeing machines have one-way flow only. In most of our experiments the pump pressures developed at the various stages of the operation were recorded.

Analogous to the dyeing of vat colors in closed units on cotton or rayon, 3 different procedures for their application on wool deserve consideration:

(a) Impregnation of the material with the finely divided vat color in pigment form followed by subsequent reduction and fixation of the dyestuff with caustic soda and hydrosulfite.

(b) Impregnation of the wool with the dyestuff in form of its vat acid and subsequent conversion of the leuco to its substantive form with caustic soda and hydrosulfite.

(c) Dissolving the dyestuff by reducing it separately in a stock vat, which contains caustic and hydrosulfite in rather high concentrations, and adding it to the dyebath containing the wool, salt, and moderate amounts of alkali and hydrosulfite at a low temperature.

We do not consider procedure (a) generally applicable to wool dyeing since there are very few vat colors that reduce quickly and completely enough at the low temperatures and moderate concentrations permissible in wool dyebaths.

In the vat-acid impregnation procedure (b), the necessity of reducing the color in the presence of the wool is eliminated, and this process may be used where the vat acid can be obtained in well dispersed form, and where it may be found impossible to produce satisfactory results by our preferred stock-vat procedure (c).

The proper solution of the colors in the stock vat is of utmost importance in the dyeing of wool, since dyestuff particles that escape solution in the stock vat are not likely to be reduced subsequently. Because of their individualistic natures, it is impossible to devise a formula for dissolving vat colors which can be considered perfect for all the various dyestuffs. However, it has been found that a stock vat containing 50 grams of standard color paste, 10-12 grams of caustic soda and an equal amount of hydrosulfite per liter may be used for the majority of both the anthraquinone and indigoid vat colors. Based on the 50 grams normally vatted in one liter, one pound of dyestuff paste requires 2½ gallons of stock vat containing 3⅜ oz each of caustic soda and hydrosulfite. The reducing time should not be over 10 minutes at the temperature specified. In order to prevent local overconcentrations, the addition of the strongly alkaline stock vat to the dyebath should be made gradually over a period of about 5 minutes.

TYPICAL DYEING PROCEDURE ——As an example we will discuss the dyeing of a heavy shade of Carbanthrene Blue GCD Double Paste, C I 1113, which is a typical IN color requiring a highly alkaline bath. In figure 1 the pH readings (solid line) and the temperatures of the dyebaths (broken line) taken at the various stages of the dyeing operation are plotted against the elapsed time.

625 grams of 64's worsted top was wound tightly, and with little twist, on a perforated spindle and compressed to a volume of 2100 ml. This corresponds to a compression ratio of about 3.4 to 1, where compression ratio is defined as the volume in milliliters occupied by one gram of wool. This top was set into the experimental laboratory machine described above, which was then charged as follows:

Step (a):

5400 ml of water at 75° F, to which were added during 10 mins
15 ml Calgon 10% solution
6 ml Tergitol #4
31 ml glue 10% solution
200 grams salt

Step (b):

231 ml of caustic soda, 10% sol by volume, and
35 grams of sodium hydrosulfite were added alternately in small portions over a period of 5 minutes. The pH rose sharply from 9.0 to 12.3.

Step (c):

1000 ml of stock vat containing 50 grams of color paste and 11.3 grams each of caustic soda and hydrosulfite were added. The pH reading showed a further slight rise to about 12.5.

Step (d):

It is during this step that the dyeing proper takes place. The pH is at its highest point at the start of the dyeing when the temperature is the lowest. While the temperature is gradually increased, the pH drops perceptibly to about 12.0 by the time the bath has reached the final dyeing temperature.

Note: The shaded area in figure 1 represents the range of alkalinity in which Clayton Yellow test paper shows a change starting from a faint orange at a pH somewhat below 12, and becoming a deep orange at pH 13, and indicates the range of suitable alkalinity.

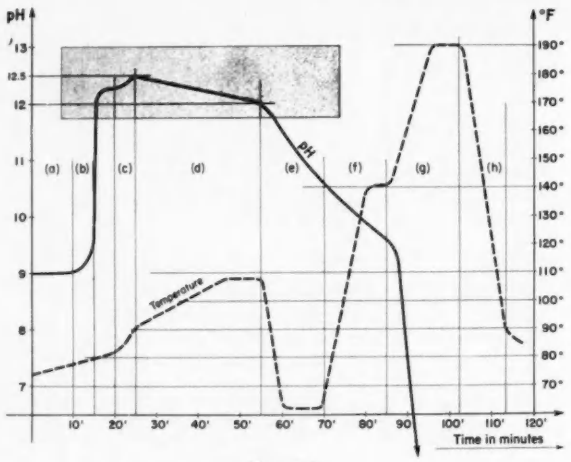


Figure 1
Dyeing Wool with Anthraquinone Vat Colors

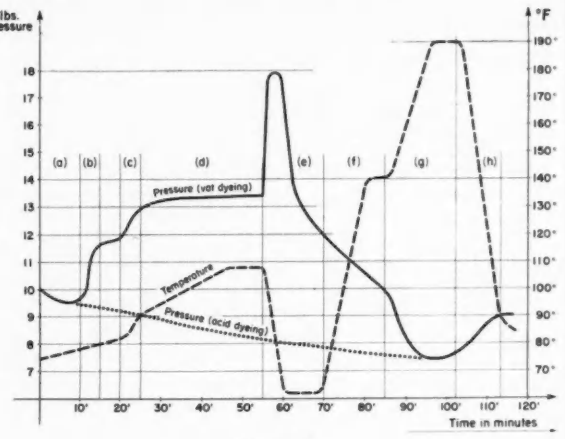


Figure 2
Dyeing Wool with Anthraquinone Vat Colors
Pressure Observations When Dyeing Highly Compressed Top

Steps (e) and (f):

Upon completion of dyeing the batch is rinsed with water at 50°-70° F, bath overflowing, until the liquor is colorless and nonreactant to phenolphthalein paper. The rinse water is then heated, still partly overflowing, to 140° F. With a good flow of water, anthraquinone vat colors dyed on wool require about 30 minutes for rinsing and oxidizing with cold and hot water.

Steps (g) and (h):

Certain anthraquinone vat colors will have reached their final shade and fastness properties after the hot water rinse at 140° F, and the dyeing may be considered completed at this stage. Among these are such light shades as baby blues, greens and yellows, which are bleached after dyeing. On the other hand, many of them may be improved in shade and/or fastness properties when given a treatment with 5%-8% of sulfuric acid for 10 minutes at 190° F, followed by a cold rinse.

In the dyeing of heavy shades with vat colors on wool, an efficient backwashing before drying is often necessary, and should be considered a part of the dyeing process. A portion of the dyestuff left in the bath upon completion of the dyeing may be precipitated onto the goods during the rinsing, and it is difficult to remove these loose color particles while the top is in tightly packed form. However, a passage on the backwasher through one or several bowls containing soda ash and a nonionic synthetic detergent will satisfactorily remove such surface pigments.

PUMP PRESSURES———A characteristic of the dyeing of wool with anthraquinone vats is the swelling of the fiber, which tends to impede the flow of the dyeliquor through the goods so that a considerably higher pump pressure is required than is needed to force an acid or chrome dye liquor through similarly compressed top. In figure 2, the pressure readings that were observed during the various phases of the dyeing process discussed in connection with figure 1 are shown by the solid curve, the temperatures again being indicated by the broken line. During step (b), when the caustic soda is added to the dyebath, the pressure increases sharply and takes a further rise during step (c). The degree of the rise in pressure indicates how much additional power is needed to force a fairly constant flow of liquor through the material. A surprising feature, which is invariably observed, is the sharp rise in the curve as soon as the rinse water is turned on. The pressure requirements are at their peak during the first few minutes of the cold rinse, after which they drop rapidly and reach the lowest point in the hot sulfuric acid bath. It will be noted from the curve that during the final rinsing (step h) the pressure is equal or somewhat lower than it was at the start (step a), i e, before the addition of the caustic soda. We found this to be true in all cases of top dyeing, both on laboratory-scale machines and when dyeing standard-size tops on a plant scale, and we consider it to be sufficient justification for our assumption that such swelling of the fiber as is caused by the caustic alkali used in our process is completely reversible.

The dotted section of the pressure curve in figure 2 indicates the approximate pressure requirements under otherwise analogous conditions when wool is dyed with acid or chrome colors.

In the case of the dyeing discussed in connection with figure 2, the top was rather tightly wound, the compression ratio being 3.4 to 1. If the material is not so tightly compressed, the increase in pressure caused by the swelling is much less pronounced and may become negligible.

In figure 3 are plotted the pressures obtained under analogous experimental conditions when top was compressed at ratios of 3.1, 3.7 and 4.6 to 1 respectively. The dyeings were made with a mixture of 2 colors of the IN group, namely 4% Carbanthrene Brilliant Green Double Paste (CI 1101), and 4% Flavine GC Double Paste (Prot 9). The ratios of liquor to material were 10:1, 12½:1 and 15:1, respectively. The maximum pressure needed for dyeing the loosely compressed top (curve C) is about equal to the starting pressure required for the highly compressed top (curve A). The dyeing of a heavy shade of any vat dyestuff normally requires a higher pressure than does the dyeing of a light shade of the same color.

In the dyeing of acid colors in practice, it is possible, even with tops compressed at a 3 to 1 ratio, to obtain excellent liquor flow by using a propeller circulating system working at pressures below 5 lb. If propeller circulation is used for dyeing anthraquinone vat colors on equally compressed top, the liquor flow will probably decrease to a dribble upon the addition of the caustic soda and the stock vat to the dyebath and will be insufficient during the rinse following the dyeing. Level results obviously cannot be obtained with such an inadequate liquor flow. There are two ways of securing im-

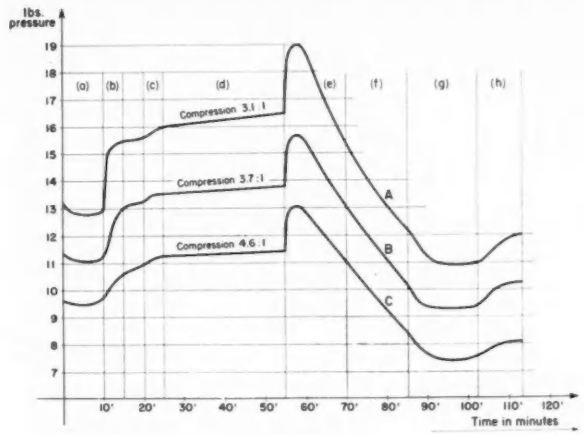


Figure 3
Dyeing Wool with Anthraquinone Vat Colors
Relation of Pressure Readings to Degree of Compression

proved circulation in such low-pressure equipment, namely, by dyeing the top in a less compressed state, or by installing pumps capable of delivering a higher pressure.

Satisfactory flow in low-pressure equipment may be obtained by dyeing only 4 or 5 tops on a spindle normally loaded with 6 tops for acid colors. This procedure has the drawback of decreasing the capacity of the dyeing machines.

The second and often more satisfactory means of effecting a good flow with an alkaline vat liquor is by installing centrifugal pumps driven by motors adequate to produce pressures as high as 25 lbs per square inch. There should be a bypass or other device to enable operation at lower pressures during the finishing rinses. The power required to furnish an ample and fairly constant flow of alkaline liquor through compressed tops appears to lie between 1/3 HP and 1 HP for each 10-lb top.

PRACTICAL EQUIPMENT ——— With regard to the adaptability for vat dyeing of some of the equipment in current use for top dyeing with acid colors, an unfavorable feature is the fact that the dyebath is often too freely exposed to the access of air, such as in cases where the liquor cascades from the dye tank into the expansion tank. There is then danger of precipitation of color from oxidation of hydrosulfite before the dyeing is completed. Dyestuff so deposited on the goods is often too difficult to redissolve completely by the addition of more hydrosulfite and caustic soda.

If we were to define an ideal machine for the dyeing of wool top with vat colors, it would have the following principal features:

1. Enclosed molybdenum-stainless-steel construction.
2. Jacket for heating and cooling with steam and water respectively.
3. Sufficiently powerful motor and pump to develop a pressure up to 25 lb per sq inch and to permit an abundant flow of vat liquor even through strongly compressed top.
4. Suitable overflow arrangement allowing the rinse water to flow directly to the sewer instead of being returned to the expansion tank.

Machines of the above general type are in use in many cotton dyehouses.

CAUSTIC AND HYDRO TABULATION

It will greatly facilitate the duplication of shades, if batches of reasonably uniform size are dyed on a given machine, so that a definite ratio of liquor to material can be maintained. As previously stated, the amounts of salt, caustic soda and hydrosulfite which are charged into the dyebath depend on the liquor-to-material ratio. It is therefore obvious that the volumes of the dyekettle and expansion tank must be known. In Table #I are listed, for various liquor ratios, the quantities of caustic soda and hydrosulfite that were found to give satisfactory results in closed equipment. They are charged into the bath independently of the quantity of stock vat, which is subsequently added. As seen from the table, the minimum amount of caustic soda is 2.4%, and is used for dyeing IK colors in the short liquor ratio of 10:1.

It will be noted from Table I that there are considerable differences between colors of the IN, IW and IK groups with regard to the amount of caustic soda required in the dyebath. It is obvious that whenever the desired shade can be matched, without sacrifice of fastness properties, with colors of the IK group or with indigoid vats, these should be given preference over the IN types.

DYE TABULATION ——— The amounts of common salt that were found suitable for use with the various anthraquinone vats are listed in comprehensive Table II, which also contains other characteristics pertinent to the various dyestuffs, including a selection of indigoid vats.

TEMPERATURE ——— The temperatures that we recommend for the dyeing of anthraquinone vats on wool are much more uniform than those used for their application on cotton. Dyeing is normally begun at 80-95° F, the higher starting temperatures being used for the heavy shades. Over a period of 15 to 20 minutes, the bath is raised to the final dyeing temperature, which is 105° to 110° F for the IN colors and 110° to 115° for the IW and IK types. In each case lower temperatures are preferred for dyeing finer qualities, higher temperatures for dyeing coarser grades, such as carpet stock.

TIME———The time of the dyeing proper, counted from the moment all the stock vat is added, is from 25-35 minutes. The total time of the operation ranges between 1 hour and 2½ hours. Dyeing in

TABLE I
ANTHRAQUINONE VAT COLORS—CAUSTIC AND HYDRO REQUIREMENTS

Ratio of Liquor to Material	IN—Colors						IW—Colors						IK—Colors					
	Caustic Soda Per 100 Gal			Hydrosulfite Per 100 Gal			Caustic Soda Per 100 Gal			Hydrosulfite Per 100 Gal			Caustic Soda Per 100 Gal			Hydrosulfite Per 100 Gal		
	%	lb	oz	%	lb	oz	%	lb	oz	%	lb	oz	%	lb	oz	%	lb	oz
10:1	3.7	3	1.5	5.6	4	11	3.0	2	8	5.2	4	5	2.4	2	—	4.8	4	—
15:1	4.4	2	6.5	6.7	3	12	3.6	2	—	6.2	3	7	2.8	1	9	5.6	3	2
20:1	5.0	2	1	7.6	3	3	4.0	1	10.7	7.0	2	15	3.1	1	4.7	6.2	2	9
30:1	5.9	1	10	9.0	2	8	4.5	1	4	8.0	2	4	3.6	1	—	7.2	2	—
40:1	6.5	1	6	10.0	2	2	4.8	1	—	9.0	1	14	3.9	—	13	7.8	1	10

TABLE II

	Colour Index or Prototype	Color Class Preferred	Color Class Alternate	Temp °F	Stock Vat Grams per lb Color per Liter	Stock Vat Gallons of Dyestuff	Common Salt Oz/Gal of Dyebath Light Shades	Common Salt Oz/Gal of Dyebath Medium Shades	Common Salt Oz/Gal of Dyebath Heavy Shades	Fastness to Light: Sunlight Light	Sunlight Medium	Sunlight Heavy	Fade-Ometer Light	Fade-Ometer Medium	Fade-Ometer Heavy
Carbanthrene Red G2B Double Paste	Pr 124	IN	—	140	25	5.0	1.0	2.0	3.0	6	7	8	6	7	8
Carbanthrene Red FBB Double Paste	Pr 296	IW	IN,IK	140	50	2.5	1.5	3.0	5.0	4	4	5	3	4	5
Carbanthrene Red BN Double Paste	1162	IK	IW	140	50	2.5	2.0	4.0	6.0	6	7	8	6	7	8
Carbanthrene Golden Orange RRT Paste	1098	IN	—	140	50	2.5	1.0	2.0	3.0	7	7	6 (d)	7	7	6 (d)
Carbanthrene Golden Orange G Double Paste	1096	IN	IW	140	50	2.5	1.0	2.0	3.0	6	5 (d)	5 (d)	6	5 (d)	5 (d)
Carbanthrene Golden Orange 3G Paste	Pr 290	IW	IN,IK	140	75	1.7	1.5	3.0	5.0	8	7 (d)	7 (d)	8	7 (d)	7 (d)
Carbanthrene Yellow 3R Paste	Pr 452	IW	IN	140	50	2.5	1.5	3.0	5.0	8	7 (d)	7 (d)	8	7 (d)	7 (d)
Carbanthrene Yellow AR Double Paste	1132	IK	IW	140	50	2.5	2.0	4.0	6.0	7	7	8	7	7	7
Carbanthrene Flavine GC Double Flakes	Pr 9	IN	—	140	50	2.5	1.0	2.5	4.0	5	6	5 (d)	5	6	5 (d)
Carbanthrene Brilliant Green Double Paste	1101	IN	IW	140	50	2.5	1.0	2.5	4.0	7	8	8	7	8	8
Carbanthrene Olive Green B Paste	Pr 293	IW	IN	140	75	1.7	1.0	2.5	4.0	7	8	8	7	8	8
Carbanthrene Blue Green FFB Double Paste	Pr 444	IN	—	140	50	2.5	0.5	1.0	2.0	6	7	8	6	7	8
Carbanthrene Blue 3G Double Powder	1109	IN	—	120	50	2.5	1.5	3.0	4.0	7	8	8	7	7	8
Carbanthrene Blue GCD Double Paste	1113	IN	—	130	50	2.5	1.0	2.5	4.0	7	8	8	7	8	8
Carbanthrene Blue BCF Double Paste*	1114	IN	—	130	50	2.5	1.0	2.5	*	7	8	*	7	8	*
Carbanthrene Brilliant Violet RK Paste	1135	IW	IK,IN	140	50	2.5	1.5	3.0	5.0	7	8	8	7	8	8
Carbanthrene Violet 2R Paste	1104	IN	—	140	50	2.5	1.0	1.5	2.5	5	6	8	5	6	8
Carbanthrene Red Brown 5R Paste	Pr 448	IW	IN	140	75	1.7	1.5	3.0	5.0	7	8	8	7	8	8
Carbanthrene Brown NR Paste	—	IW	IN	140	75	1.7	1.5	2.5	5.0	6	7	8	6	7	8
Carbanthrene Brown BR Paste	Pr 118	IW	IN	140	75	1.7	1.5	2.5	5.0	6	6	7	6	7	7
Carbanthrene Brown AR Double Paste	1151	IW	IN	140	50	2.5	1.5	2.5	5.0	8	8	8	8	8	8
Carbanthrene Brown AG Double Paste	1152	IW	IN	140	50	2.5	1.5	2.5	5.0	7	8	8	7	8	8
Carbanthrene Olive R Double Paste	1150	IW	IN	140	50	2.5	1.5	2.5	5.0	7	8	8	6	7	8
Carbanthrene Khaki 2G Double Paste*	Pr 122	IN	—	140	50	2.5	1.5	2.0	*	7	8	*	7	8	*
Carbanthrene Olive T Paste*	—	IN	—	140	75	1.7	1.5	2.0	*	7	8	*	7	8	*
Carbanthrene Grey GFL Paste*	—	IN	—	140	50	2.5	1.5	2.0	*	5	7	*	5	7	*
Carbanthrene Black BF Double Paste#	1102	IN	—	140	Greys-50 Black-80	2.5 1.5	1.5	3.0	5.0	5	6	8	5	7	8
Vat Pink FF Paste	Pr 109	Thioindigoid		175	50	2.5	—	—	—	6	7	6 (d)	5	7	6 (d)
Vat Red Violet RH Paste	1212	Thioindigoid		175	50	2.5	—	—	—	6	7	8	5	6	7
Vat Red Violet 6R Paste	—	Thioindigoid		175	50	2.5	—	—	—	6	6	8	5	6	7
Vat Orange R Paste	1217	Thioindigoid		160	50	2.5	—	—	—	3	4	5	2	3	5
Brilliant Indigo 4BR Flakes	1184	Indigoid		140	50–60	2.5–2.0	—	—	—	6	7	8	5	6	8
Brilliant Indigo KMR Double Paste	1183	Indigoid		140	50–100	2.5–1.3	—	—	—	5	7	8	5	6	8
Vat Brown G Paste	Pr 121	Thioindigoid		150	50	2.5	—	—	—	7	8	8	8	8	8

*Products marked with an asterisk are suggested for dyeing light and medium shades only.
#The shade of Carbanthrene Black BF is developed by a treatment with sodium nitrite and sulfuric acid at 70°F.
(d)Denotes shade darkens on prolonged exposure.

the shortest time can be effected if the equipment permits the goods to be entered into the liquor while in the dry state and/or if the final treatment with hot acid can be omitted without sacrifice of color fastness. The normal operating time is two hours.

INDIGOID AND THIOINDIGOID VATS

Space does not permit a detailed discussion of our method of applying indigoid and thioindigoid vat colors. It may be briefly stated that they are dissolved in stock vats similar in concentrations of color, caustic soda and hydrosulfite to those used in the dissolving of anthraquinone vats. The dyebath is charged with 8% to 12% of trisodium phosphate crystals ($Na_3PO_4.12H_2O$) in place of the caustic soda used for the anthraquinone vats. In the case of some thioindigoid vats, small amounts of caustic soda are added in addition to the phosphate. The pH of the bath in the dyeing of indigoid and thioindigoid vats is usually about one full point lower than in the dyeing of anthraquinone vats. According to the depth of the dyeing and the ratio of liquor to material, 5%-10% of hydrosulfite is charged into the dyebath. In most cases salt is not added. The dyeing is started at 90°-100° F, the temperature is raised to 120° F and kept at 120° F for 10-15 minutes. The wool is then rinsed cold until the water runs colorless. 1%-2% of sodium bicarbonate and 2% of hydrogen peroxide, 27%, are then added, and the liquor is heated within about 15 minutes, while partly overflowing, to 140° F. 2% of Nacconol NR is then charged, the temperature is raised to 190° F and kept at 190° F for 10 minutes, when the batch is rinsed and soured at 100° F with 2% of sulfuric acid.

GENERAL PROPERTIES OF VAT DYEINGS ON WOOL

When dyed under the conditions outlined in this paper, most vat colors have good affinity for wool. While they exhaust somewhat more slowly on wool than on cotton, they build up to a greater depth, which is usually between 150% and 200% as compared with the depth obtained on cotton or on silk. As a class, vat colors have good level-dyeing properties and are less selective than the acid and chrome colors with regard to dyeing tippy wool and mixed stocks.

If properly dyed and backwashed, vat colors on wool have satisfactory fastness to crocking and have outstanding fastness to washing, fulling, peroxide-bleaching and other wet-processing operations. They exhibit a striking superiority over chrome colors with regard to crossdyeing in a boiling sulfuric acid bath, showing no change of shade and no bleeding on white wool. The exhibit (slide, photograph) shows the difference in fastness between dyeings of Superchrome Black TS, C I 203 and Carbanthrene Black BF, C I 1102, crossdyed for one hour at the boil with 0.1% of Chromolan Yellow BEN and 4% of sulfuric acid. Other chrome colors show similar bleeding on white wool in a strong sulfuric acid bath, while vat colors of corresponding shade and depth leave the ground unstained.

As a class vat colors on wool have outstanding fastness to light. Certain types, such as Carbanthrene Flavine GC, Vat Pink FF and Brilliant Indigo 4BR, are considerably faster to light on wool than they are on cotton. Proper selection permits the development of a full range, including light and bright shades, of a fastness rating at least equal to AATCC standard #6, both in sunlight and in Fade-Ometer exposure. Many light shades of bright greens, blues and violets and also the three popular carpet shades of beige, rose and green show no fading after 200 hours of Fade-Ometer exposure or after 3 months of summer exposure to the sun.

CHLORINATED WOOL———Most of our work on chlorinated wool was done

on top treated by the Harriset process. The dyeing and fastness results obtained were very similar to those obtained on regular top. Tests conducted for us by the Harris Research Laboratories on over 120 shades indicate that vat colors dyed on wool, as a whole, have good fastness to the Harriset treatment, i e, most of them may be chlorinated after dyeing.

PRESENCE OF OTHER FIBERS——In the dyeing of yarn or fabrics containing cotton or rayon besides wool, rayon is normally dyed darker, cotton often somewhat lighter than the wool. With some colors there is a considerable shade difference. Thus, anthraquinone vat blues dye wool appreciably redder than cotton.

DYEING YARN AND PIECE GOODS——With regard to dyeing wool in the form of yarn and piece goods, considerably less work was done by us than on top dyeing.

Woolen and worsted yarn may be dyed on packages in closed machines by formulas similar to those given for top dyeing. We have with us 2 one-pound packages of 2/38 worsted yarn dyed in the laboratory machine with 2% of Carbanthrene Blue GCD Double Paste and 2% of Vat Pink FF Paste, respectively.

In our opinion the most suitable process for dyeing piece goods would be a padding of the material (previously treated with a rewetting agent, such as a 2% solution of Nacconol NR) with the color in the form of its vat acid and subsequent development in full width in a bath containing the required amounts of caustic soda, hydrosulfite and salt under little or no tension.

COST OF VAT DYES ON WOOL——With respect to the cost of dyeing wool with vat colors, the actual expense for light shades may be lower than with chrome colors, inasmuch as the steam consumption is less and the equipment is tied up for a shorter time. When heavy shades are dyed, vat dyeing is more expensive than chrome dyeing because of higher dyestuff cost, and it only comes into consideration where brilliancy and/or fastness properties of the chrome colors are lacking.

Compared with the vat dyeing of cotton or silk, the cost of dyeing wool is lower, since less color is needed to dye wool a certain depth than is required for cotton or silk.

CONTROL OF THE DYEING PROCESS——In line with the dyeing of other fibers with vat colors, application of these dyes on wool should be based on formulas developed in the laboratory. The amounts of chemicals, especially of caustic soda, must be carefully calculated and weighed on good scales. Accurate thermometers must be available. Inasmuch as the dyeing temperature is low, it is comparatively easy to hold it within 2 or 3° F.

To check the alkalinity of the bath, pH readings may be made with high-alkali electrodes. Clayton Yellow test paper is another indicator for testing the degree of alkalinity of an anthraquinone vat dyebath. The dyeliquor is poured from a small glass beaker onto one side of the paper. The degree of the initial stain is observed, and often also the time it takes for the stain to disappear. In cases where the color of the leuco interferes with the reading on the Clayton Yellow, phenolphthalein paper is used as an additional check. In the dyeing of indigoid vat colors, phenolphthalein paper is employed almost exclusively. Carbanthrene Yellow G test paper serves for testing the bath for hydrosulfite.

The dyeing of wool with vat colors requires working under more carefully controlled conditions than does dyeing with acid or chrome colors. However, the same is true of vat dyeing cotton or viscose compared with the dyeing of these fibers with direct or developed colors. It is suggested that, before full-scale operations, sample runs be made on one-pound or preferably one-top pilot machines with liquor ratios, compression of the top and other conditions comparable with those that will be met when working on a full scale. By observance of these rules good shade duplication between laboratory and plant trials can be obtained. Enough plant trials have been conducted to justify our full confidence in the feasibility of the process.

We have brought along samples of dyed raw stock, top, yarn made therefrom as well as other dyeings and fastness tests for examination by anyone interested.

CALENDAR

COUNCIL

April 20 (Raleigh, N. C.), June 15 (Hotel New Yorker, New York), October 18 (Hotel Statler, New York), November 16 (Hotel New Yorker, New York).

GENERAL RESEARCH COMMITTEE

April 20 (Raleigh, N. C.), June 15 (Hotel New Yorker, New York), October 18 (Hotel Statler, New York), November 16 (Hotel New Yorker, New York).

NATIONAL CONVENTIONS

1951: October 17-18-19, Statler, New York.
1952: Nov. 6-8, Boston.
1953: September, Chicago.

HUDSON-MOHAWK SECTION

Meetings: Mar. 16 (Albany), May 11 (Albany), June 22 (Annual Outing).

MIDWEST SECTION

Meetings: May 5 (Hotel Schroeder, Milwaukee), June 16 (Outing, Lake Lawn Lodge, Delavan, Wis.), September 29 (Morrison Hotel, Chicago).

NEW YORK SECTION

Meetings: March 9 (Hotel New Yorker), March 30 (Swiss Chalet), May 4 (Swiss Chalet), June 15 (Outing).

NORTHERN NEW ENGLAND SECTION

Meetings: March 9 (M I T, Cambridge), April 13 (L T I, Lowell), May 18 (Andover C C, Andover), October 26 (L T I, Lowell), November 30 (Boston, Annual Meeting).
Outing: June 8 (Merrimac V C C, Methuen).

PHILADELPHIA SECTION

Meetings: January 19, March 16, April 13, September 14, October 26, December 7, January 18, 1952 (all at Kugler's Restaurant, Philadelphia).

Outing: June 1 (Torresdale-Frankford Country Club).

RHODE ISLAND SECTION

Meetings: Feb. 23 (Johnson's Grill), March 30 (Providence Engineering Society), April 27 (Wannamoisett Country Club), May 25 (Johnson's Grill), October 26 (Providence Engineering Society), November 16 (Johnson's Grill).

Outing: June 1 (Wannamoisett Country Club)

SOUTH CENTRAL SECTION

Meetings: February 10, May 12, December 1 (all in Hotel Patten). Summer Outing: August 24-25.

SOUTHEASTERN SECTION

February 24 (Talladega, Ala.), May 5 (Atlanta, Ga.), June 8-9 (Annual Outing, Radium Springs, Albany, Georgia), September 8 (Columbus, Ga.), December 8 (La Grange Ga.).

WESTERN NEW ENGLAND SECTION

Meetings: March 16 (Danbury), May 4, June 22 (Outing).

OTHER EVENTS

AMERICAN ASSOCIATION OF TEXTILE TECHNOLOGISTS

Meetings: February 28 (Hotel Commodore, New York); April 4, May 2, June 6, September 12, October 3, November 7, December 5 (Builders Club, New York).

AMERICAN SOCIETY FOR TESTING MATERIALS

Committee E-12 on Appearance, February 27, Washington, D. C.

Committee D-13 on Textile Materials, March 14-16, New York.

Committee D-12 on Soaps and Other Detergents, March 19-20, New York.

Spring Meeting and Committee Week, March 5-9, Cincinnati, Ohio.

Annual Meeting, June 18-22, Atlantic City, N. J.

Spring Meeting and Committee Week, March 3-7, 1952, Cleveland, Ohio.

Annual Meeting, June 23-27, 1952, New York, N. Y. (The biennial Apparatus and Photographic Exhibits will be held in conjunction with this meeting).

NATIONAL ASSOCIATION OF TEXTILE MACHINERY MANUFACTURERS

Exhibit of American Textile Machinery, April 26-May 1, 1954, Atlantic City Exhibition Hall, Atlantic City, N. J.

TEXTILE RESEARCH INSTITUTE

Annual Meeting, Nov. 8-9.

Intersectional Contest Third Prize Winner —

THE RELATING OF LABORATORY DATA TO MILL PRACTICE*

PHILADELPHIA SECTION

The Philadelphia Section has constructed a single- and a multi-unit dyeing apparatus, in which wool dyeings can be carried out under controlled conditions of temperature and agitation for a study of the sorption and desorption of acid dyes on wool with variations of time and temperature. The same technique has been extended to the study of the dyeing of metallized acid dyestuffs on wool, of acid dyestuffs on bright filament nylon and of acid dyes on spun-nylon yarn.

The use of the data to indicate level and unlevel dyeing types is pointed out. It is also shown how the apparatus can be used to parallel closely the exhaustion curves obtained in the mill practice.

Committee

H F Clapham, *Chairman and Speaker*
C T Anderson
E C Dreby
A W Etchells
A F Felgendreger
T R Foltz
J W Killheffer
C J Monego
F J Rizzo
T J Scanlon
R B Stehle
F V Traut
L I Weiner
P Theel

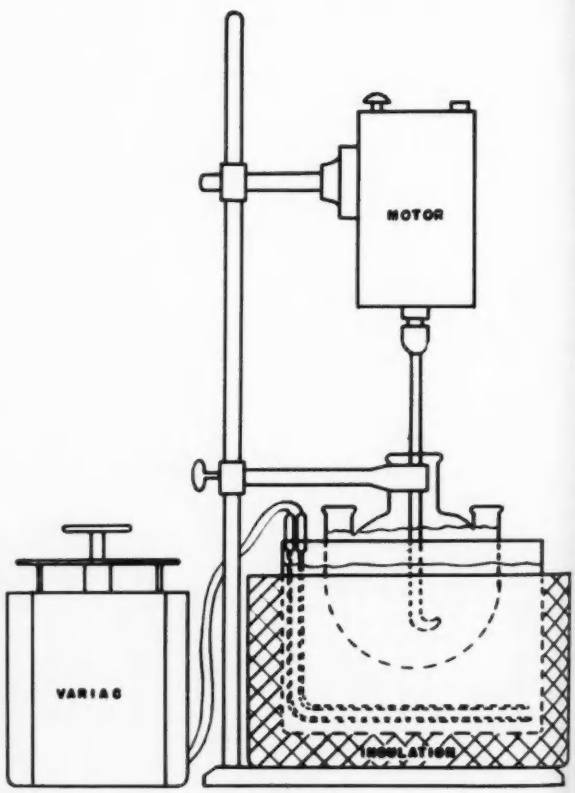
INTRODUCTION

In considering possible subjects for an Intersectional Contest Paper for this year, the Philadelphia Section finally decided that a paper on the rate of dyeing of colors on wool offered possibilities for interesting and useful work. It is fully realized that the subject has been exhaustively studied by many different workers. However, in general the work has heretofore been aimed at obtaining dyeing rates with little regard to actual mill operation other than to assume a set of standard conditions that would be generally applicable.

Dye manufacturers and others have compiled voluminous data in the form of tables, and curves derived from them, that show the relative rates of exhaustion for dyes. These curves are restricted to a dyebath condition that, in the case of the dye

* Presented before the Twenty-ninth Annual Meeting in Portsmouth, N H, on Sept 29, 1950.

Photograph 1



Drawing 1

manufacturer, represents an average condition, which rarely duplicates the conditions existing at a specific mill. On the other hand, scientific workers have used conditions that will never exist in practice, such as purified wool, purified dyes, excesses of salts, acids and time cycles.

In this paper we present a simple method of obtaining exhaustion rates for dyestuffs, either singly or in combination, using laboratory equipment that can readily be assembled in any textile mill and with sufficient flexibility of operation to permit duplication of mill conditions. We propose to show that it is possible by simple manipulation to duplicate quite closely the results that are obtained in the mill and thus to present a method by which mill chemists and dyers can set up equipment to evaluate new dye offerings under their exact operating conditions for their exhaustion rates and possibly to obtain valuable information as to their level-dyeing characteristics. While practically all of the work reported in this paper was done on wool with acid-color types, sufficient exploratory runs were made on cotton and nylon to indicate that the method is equally applicable to other dye types on other fibers.

Before attempting mill laboratory duplication of bulk runs, we must be aware of certain facts. Some of these are found in the literature.

Thus we find that dry wool is incapable of absorbing molecules of greater size than 6 Å, whereas wool swells when immersed in water at normal temperature until the pore size is 41 Å *(1)*. This condition can be altered by the scouring method and the contents of the scouring bath. Other factors, such as natural weathering, bleaching, and treatments with anion-active agents, change the rate of absorption *(2)*.

The degree of fineness of the fiber has been shown to influence the dye absorption by wool (Philadelphia Section AATCC 1947) and the same reference states that the products of three different dye manufacturers may differ in dyeing-rate curves even when they are all listed under the same *Colour Index* number. These facts point out the importance of duplication of all materials and conditions if laboratory work is to check mill practice.

OBJECTIVES ——— The work of the Philadelphia Intersectional Contest Committee can be divided into three parts:

1. To develop a simple method of measuring exhaustion rates with laboratory equipment that is readily available in mill laboratories.

2. To check the proposed method carefully to assure that it can be correlated with full-scale dyeing procedures so that the data developed can be relied upon for use in mill dyeing.

3. To develop data on the exhausting rates of dyes, which explain some of the dyeing phenomena that are known to take place in practice.

EXPERIMENTAL

LABORATORY WORK ——— With these three objectives in view, we have designed a simple but versatile laboratory apparatus. This is simple in its elements, consisting of an insulated water bath, a heating coil regulated with a variable transformer, a stirrer with a speed regulator, and an instrument (colorimeter or spectrophotometer) for reading the strength of solutions (see Photograph I and Drawing I).

An insulated water bath can be constructed inexpensively by placing a 7-pint enameled kettle within a 15-pint enameled kettle and filling the space between with powdered asbestos.

The heating coil is a 750-W immersion-type heater placed on the bottom of the inner kettle, which contains a 40 per cent solution of sodium formate.

A variable voltage controller is attached between the heating coil and the power source so that the temperature of the formate bath can be regulated.

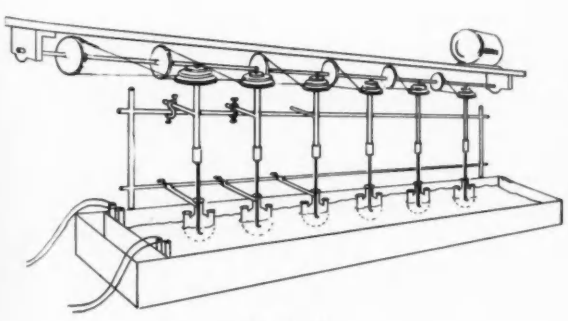
The dyebath is contained in a ½-liter, 3-hole flask, which is supported by a clamp. The flask is immersed to the depth of the dyebath in the formate solution.

The stirrer is supported over the flask, and a glass rod having a slight crook at the end is used to agitate the dyebath.

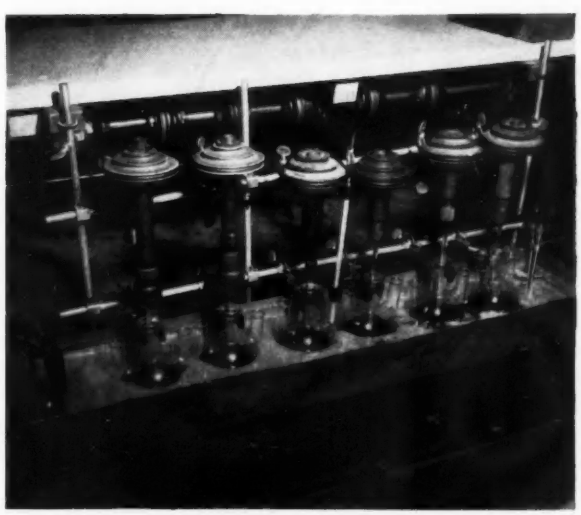
A multi-unit bath has also been constructed for use when data are required on several samples, all of which are to be tested under the same conditions of time, temperature, etc. A considerable saving in time is made possible by using the multi-unit set rather than making consecutive runs with the single-unit apparatus (see Photograph II and Drawing II).

The multi-unit set consists of a lead tank, which is 42 inches long by 8½ inches wide, having a depth of 4 inches. The tank contains a drain at one end and an inverted dam before the drain. A jack shaft for pulleys is located 8 inches behind and 16 inches above the bottom of the tank.

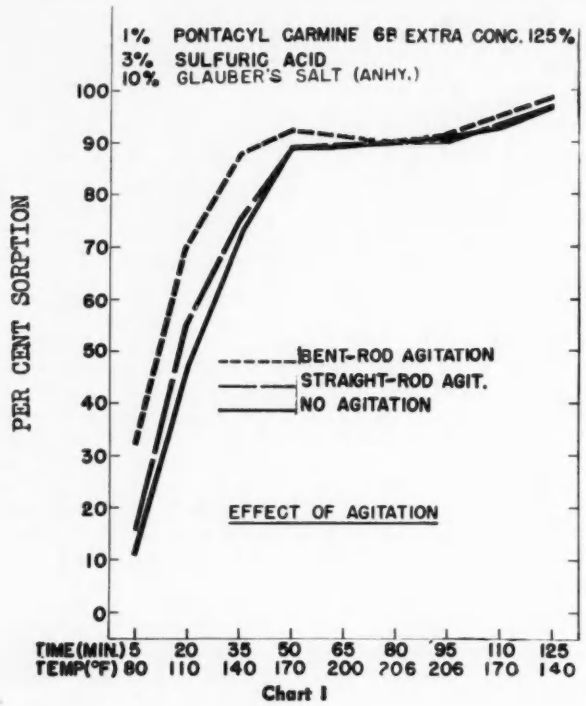
The power source is a ¼-HP motor running at 1750 rpm with a 2-inch pulley on the motor shaft. This drives a 12-inch pulley on a jack shaft, which holds 6 pulleys, each having a diameter of 2 inches. Belts run from the jack-shaft pulleys to 3½-inch pulleys on vertical stirrers, this setup producing a stirring speed of 166 rpm.



Drawing II



Photograph II


1% PONTACYL CARMINE 6B EXTRA CONC. 125%
3% SULFURIC ACID
10% GLAUBER'S SALT (ANHY.)
PER CENT SORPTION
BENT-ROD AGITATION
STRAIGHT-ROD AGIT.
NO AGITATION
EFFECT OF AGITATION
TIME (MIN.) 5 20 35 50 65 80 95 110 125
TEMP (°F) 80 110 140 170 200 206 206 170 140
Chart I

The tank is filled with water to a depth of 2½ inches, on which is floated sufficient petrolatum to cover the surface with a thin layer. This prevents the evolution of steam, thereby retarding evaporation and maintaining the desired bath temperature. The purpose of the inverted dam is to prevent drainage of the petrolatum with consequent drain stoppage. The tank is heated with 2 or 3 immersion-type electric heaters having a total wattage of 2 kw.

The six dyebath units are the same as that used in the individual unit previously described and are immersed to the depth of the dyebath in the water bath.

The above-described multi-unit set produces the time-temperature cycle listed below without the necessity of having a variable voltage controller.

A typical run with this apparatus would proceed as follows, it being understood that this is only an example and that the procedure can be altered to fit any mill condition.

A dyebath is made up to duplicate the mill run for volume ratio, color, dyeing assistants and material to be dyed. A 5-ml sample of the dyebath is reserved as a control. For this particular run we will

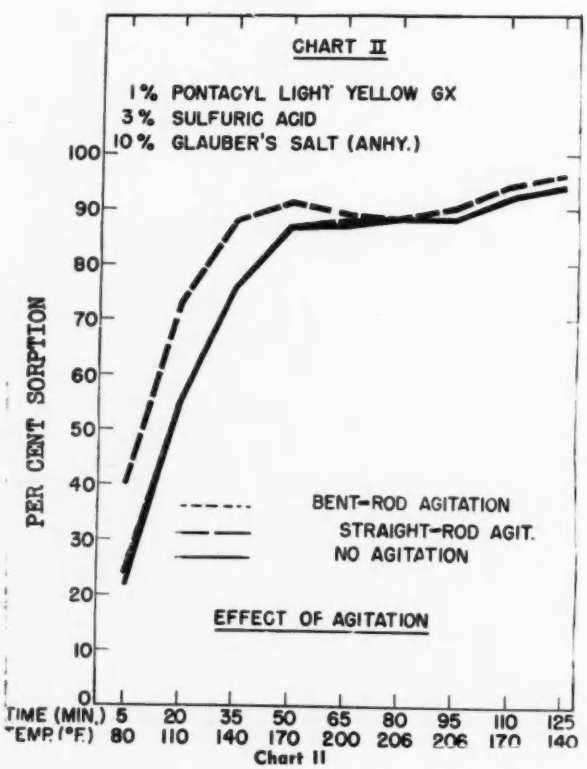


CHART II
1% PONTACYL LIGHT YELLOW GX
3% SULFURIC ACID
10% GLAUBER'S SALT (ANHY.)
PER CENT SORPTION
BENT-ROD AGITATION
STRAIGHT-ROD AGIT.
NO AGITATION
EFFECT OF AGITATION
TIME (MIN.) 5 20 35 50 65 80 95 110 125
TEMP (°F) 80 110 140 170 200 206 206 170 140
Chart II

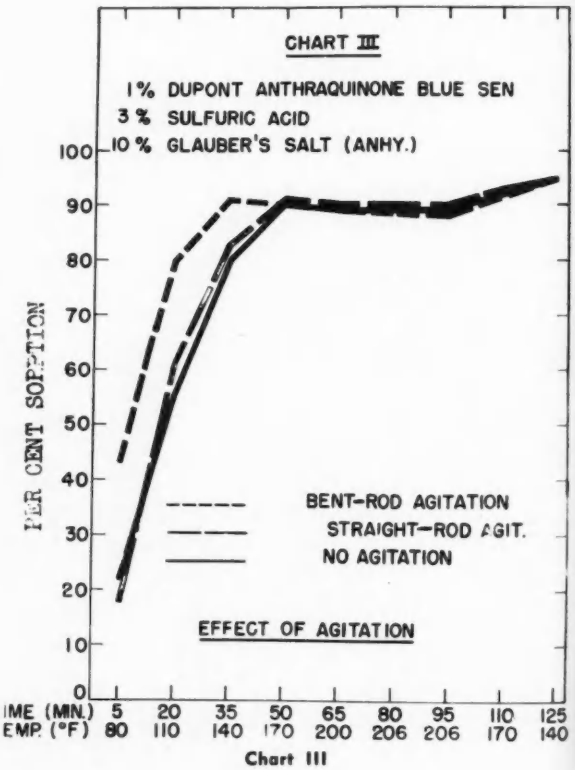


CHART III
1% DUPONT ANTHRAQUINONE BLUE SEN
3% SULFURIC ACID
10% GLAUBER'S SALT (ANHY.)
PER CENT SORPTION
BENT-ROD AGITATION
STRAIGHT-ROD AGIT.
NO AGITATION
EFFECT OF AGITATION
TIME (MIN.) 5 20 35 50 65 80 95 110 125
TEMP (°F) 80 110 140 170 200 206 206 170 140
Chart III

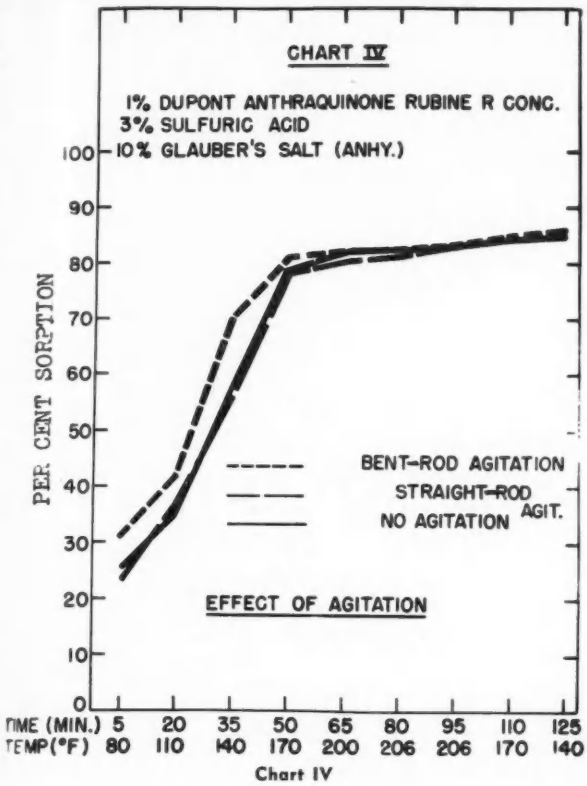


CHART IV
1% DUPONT ANTHRAQUINONE RUBINE R CONC.
3% SULFURIC ACID
10% GLAUBER'S SALT (ANHY.)
PER CENT SORPTION
BENT-ROD AGITATION
STRAIGHT-ROD AGIT.
NO AGITATION
EFFECT OF AGITATION
TIME (MIN.) 5 20 35 50 65 80 95 110 125
TEMP(°F) 80 110 140 170 200 206 206 170 140

Chart IV

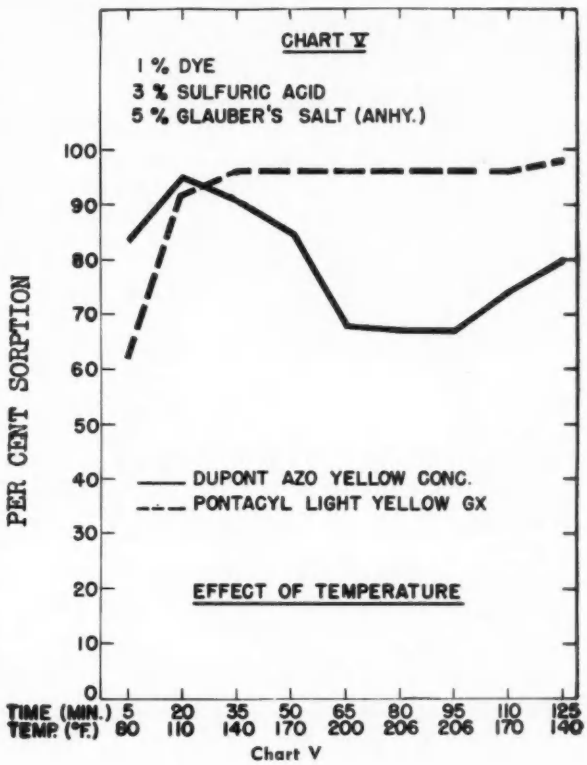


CHART V
1 % DYE
3 % SULFURIC ACID
5 % GLAUBER'S SALT (ANHY.)
PER CENT SORPTION
DUPONT AZO YELLOW CONC.
PONTACYL LIGHT YELLOW GX
EFFECT OF TEMPERATURE
TIME (MIN.) 5 20 35 50 65 80 95 110 125
TEMP. (°F.) 80 110 140 170 200 206 206 170 140

Chart V

assume an arbitrary time-temperature cycle as follows:

Minutes ..	5	20	35	50	65	80	95	110	125
Degrees F	80	110	140	170	200	206	206	170	140

Five-ml aliquots are withdrawn at each time of reading to obtain the degree of exhaustion. This cycle in general follows the same plan as has been used by other workers *(3)* except that their curves were not extended to include the effect of a cooling dyebath. This is an important difference, and more will be said later concerning this additional feature.

The figures given in Appendix I were compiled using the time-temperature cycle just described. They show the per cent dye sorption in a 50:1 volume. The *neutral* dyeings were made with 5 per cent anhydrous sodium sulfate. The acetic acid dyebaths contained the same amount of sodium sulfate and 5 per cent acetic acid, 28 per cent. The sulfuric-acid dyebaths contained the same amount of sodium sulfate and 3 per cent acid.

The figures listed in Appendix II represent sorption by bright filament nylon yarn using the same time-temperature cycle and a 50:1 volume ratio. The neutral dyeings were made without an assistant in the dyebath. Those marked "ammonium acetate" contained 10 per cent of that salt based on the weight of the nylon, and those marked "acetic acid" contained 5 per cent of acetic acid, 28 per cent.

Appendix III lists similar figures for spun-nylon yarn under the same conditions as for the bright filament yarn.

About fifteen years ago *(4)* it was reported that turbulence in a dyebath promotes more rapid exhaustion of a dye liquor. The present work confirms this report with the extremely simple technique of measuring the exhaustion from an unstirred dyebath compared with a similar bath stirred by a straight glass rod and one stirred by a glass rod with a slight bend at the end.

You will observe on Charts I-IV that increased agitation results in a steeper curve up to a point. To increase agitation beyond this point only leads to undesirable physical changes in the wool without further increase in exhaustion rate.

Other workers (3, p 153) have noted that desorption of the leveling types occurs at temperatures in excess of roughly 160-180° F. It follows that any reduction in temperature after desorption occurs will again cause absorption. Since it is impossible to remove a dyeing from the dyebath without having dye liquor entrained, absorption will continue after removal of the wool if the dyebath has not been completely exhausted (see Chart V). This explains why Azo Yellow (CI 146) does not produce level dyeings when used in mixes although it shows a desorption index of 160 compared with 47 for Yellow GX (CI 639). The color which is desorbed above 160° F is reabsorbed during the usual cooling of the dyebath and often in an unlevel, cloudy or streaky manner. The "desorption index" is explained further in this article.

Glauber's salt is a retarder because of its desorption characteristic. Actually, it does not delay the absorption of dye particles so much as it promotes desorption of the dye that has already been absorbed. The greatest degree of desorption occurs at the boil although there is a continuous action over the whole temperature range. Many workers have demonstrated this point *(5)*. Most workers use the transfer, or migration, technique where a dyed skein and an undyed skein are entered into a fresh dyebath containing all of the ingredients of the original dyebath except the dye. Following boiling in the fresh bath, the second skein is examined visually for the amount of dye transfer.

This method, which may be adequate for some purposes, does not, in our opinion, cover completely the operation of "level dyeings." It is possible by this test

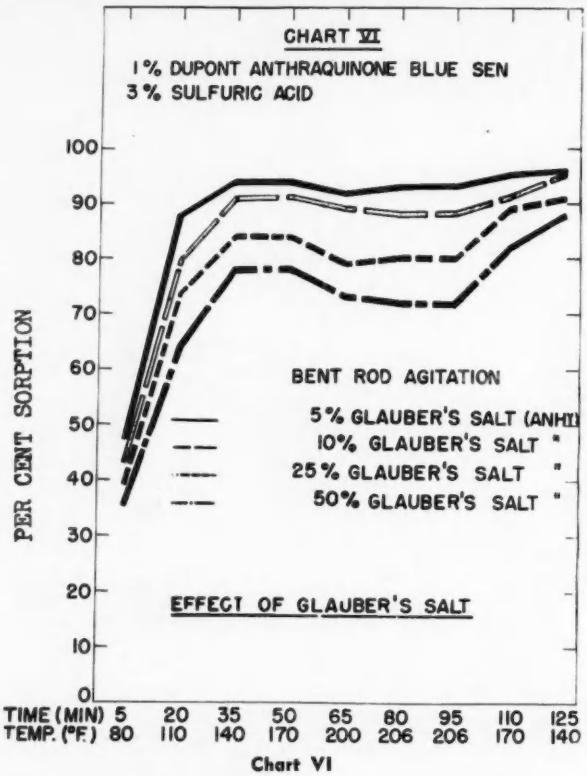


CHART VI
1% DUPONT ANTHRAQUINONE BLUE SEN
3% SULFURIC ACID
PER CENT SORPTION
BENT ROD AGITATION
5% GLAUBER'S SALT (ANHY.)
10% GLAUBER'S SALT "
25% GLAUBER'S SALT "
50% GLAUBER'S SALT "
EFFECT OF GLAUBER'S SALT
TIME (MIN) 5 20 35 50 65 80 95 110 125
TEMP. (°F.) 80 110 140 170 200 206 206 170 140

Chart VI

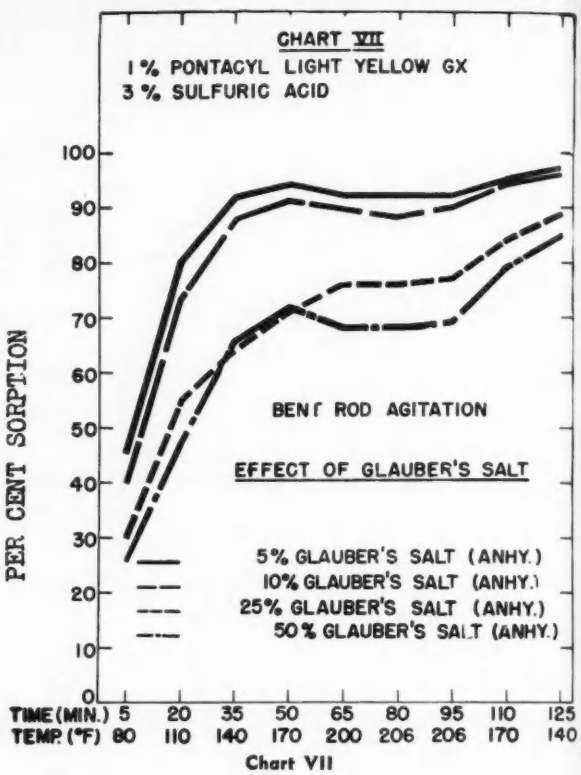


CHART VII
1% PONTACYL LIGHT YELLOW GX
3% SULFURIC ACID
PER CENT SORPTION
BENT ROD AGITATION
EFFECT OF GLAUBER'S SALT
5% GLAUBER'S SALT (ANHY.)
10% GLAUBER'S SALT (ANHY.)
25% GLAUBER'S SALT (ANHY.)
50% GLAUBER'S SALT (ANHY.)
TIME (MIN.) 5 20 35 50 65 80 95 110 125
TEMP. (°F) 80 110 140 170 200 206 206 170 140

Chart VII

to obtain on the acceptor skein a shade uniform with that of an original dyeing made from a mix of a level dyeing and a nonlevel-dyeing dye. One would deduce from this result that both of these colors are equally level dyeing, when they are not.

A more accurate method consists of a modification of the method reported in 1934 *(5)*. It will be observed that desorption, if any occurs, becomes apparent when the temperature of the dyebath nears the boil, and that increased amounts of Glauber's salt cause increased amounts of dye removal (see Charts VI, VII and VIII). This is the well-known Glauber's salt strip, which is ordinarily accomplished with large excesses of the salt. When dyeing, however, we are not dealing with excesses of Glauber's salt, but rather with 5 to 15 per cent based on the weight of the wool. If the acid were not present, all of the dye removed by the Glauber's salt would remain in the dyebath and could be measured, since there is quite general agreement among various workers that the sulfate and dye ions compete for available sites until equilibrium has been reached.

We believe that it is possible to obtain a more accurate measure of the relative dye transfer on wool by the method herein described. This consists of preparing dyeings under carefully controlled conditions followed by a partial strip with Glauber's salt, the stripping solution being read in a spectrophotometer.

Dyeings made under "carefully controlled conditions" means that ordinary pot dyeings are unsatisfactory for desorption studies just as they are unsatisfactory for absorption measurements. The rate of absorption is influenced by the degree of agitation, and the rate of desorption is likewise influenced by agitation during absorption and desorption. The apparatus described earlier is therefore used for both absorption and desorption. The absorption bath contains the dye, acid, and 5 per cent Glauber's salt; the desorption bath contains 5 per cent Glauber's salt.

A dyeing is made using the absorption technique which has been described in the foregoing pages. The resulting dyed skein is rinsed and entered into a fresh bath, which contains only water and Glauber's salt and is called the desorption bath.

The same time-temperature cycle given for absorption is also used for desorption with samples of the bath being removed at the same intervals. Because absorption and desorption progress simultaneously during normal dyeing, that is to say that there is a continuous migration of dye in both directions between the water and the wool, we are interested in the total desorption rather than desorption only at its greatest point, which is at the higher temperatures. For this reason samples of the strip bath were taken at many points during desorption, added together and measured as one.

The figure so derived is not the total dye removed but only that which is in the dyebath at the selected points; therefore, it is an index figure rather than a per cent figure. This figure is multiplied by 10 for ease of handling so as to obtain numerical ratings for each dye. Appendix IV contains desorption index figures for acid dyes on wool.

As an illustration of the superiority of the foregoing method over the skein to skein technique, a green has been produced composed of 0.5 per cent Pontacyl Light Yellow GX (CI 639)and 0.5 per cent Anthraquinone Blue SKY (CI 1088). The green made with this combination is not particularly level; still, the skein/skein method shows very little difference in shade between the two skeins. On the other hand, our method shows a desorption index of 47 when measured at 430 millimicrons, which is the wave length of maximum absorption for this yellow, and an index of 13 at 595 millimicrons, which is the wave length for the blue. This relation is to be expected from general observation during mill practice and compares very well with similar figures derived from a study of the two colors dyed separately.

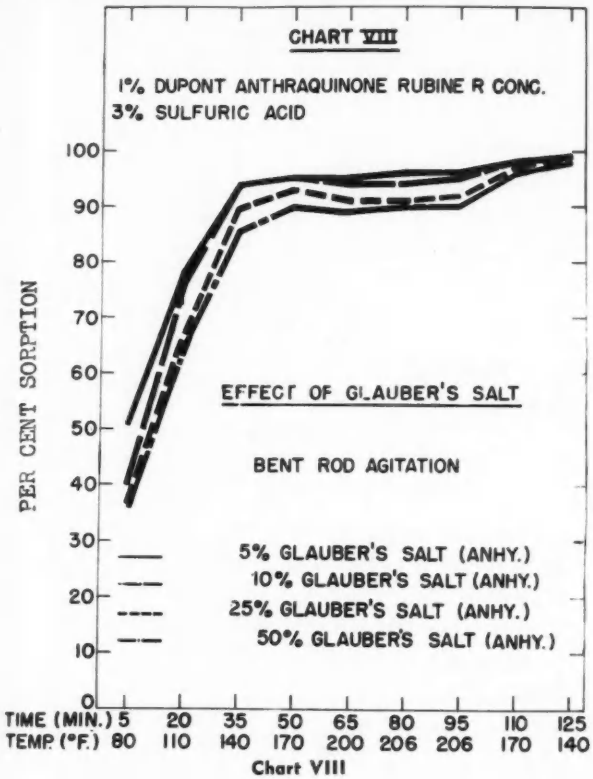


CHART VIII
1% DUPONT ANTHRAQUINONE RUBINE R CONC.
3% SULFURIC ACID
PER CENT SORPTION
EFFECT OF GLAUBER'S SALT
BENT ROD AGITATION
5% GLAUBER'S SALT (ANHY.)
10% GLAUBER'S SALT (ANHY.)
25% GLAUBER'S SALT (ANHY.)
50% GLAUBER'S SALT (ANHY.)
TIME (MIN.) 5 20 35 50 65 80 95 110 125
TEMP. (°F.) 80 110 140 170 200 206 206 170 140

Chart VIII

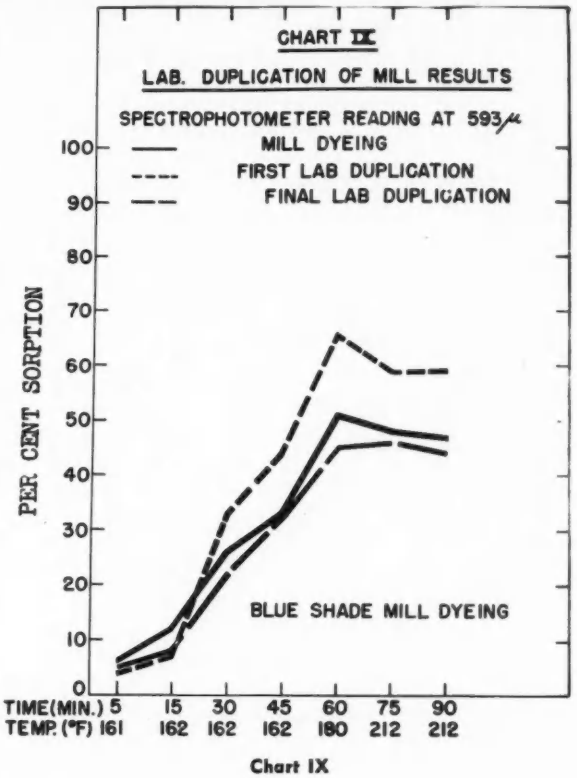


CHART IX
LAB. DUPLICATION OF MILL RESULTS
SPECTROPHOTOMETER READING AT 593μ
MILL DYEING
FIRST LAB DUPLICATION
FINAL LAB DUPLICATION
PER CENT SORPTION
BLUE SHADE MILL DYEING
TIME(MIN.) 5 15 30 45 60 75 90
TEMP.(°F) 161 162 162 162 180 212 212

Chart IX

The metallized type, unlike the ordinary acid colors, shows negligible desorption by Glauber's salt. The desorber in the case of this type is sulfuric acid, 6 per cent of acid showing an average index figure of 90 for 12 dyes compared with an average index figure of 115 when 12 per cent sulfuric acid is used. The average figure, however, should not be used, since individual dyes vary in their reaction to acid. For example, Chromacyl Blue 2G has an index figure of 60 with 6 per cent acid and 70 with 12 per cent acid whereas Chromacyl Blue R bears the figures 71 and 100. These figures indicate that Chromacyl Blue R responds more to increased acid than does Chromacyl Blue 2G. Appendix V contains desorption index figures for some metallized dyes on wool.

The rate of desorption, however, cannot be accepted as a full measure of the leveling capacity of a dye, since some portion of the desorbed dye remains in the dyebath until the temperature conditions are such that the dye is reabsorbed. This factor of reabsorption during cooling must be incorporated into any levelness factor for dyestuffs. In the work on this paper we have not been able to complete the study of leveling and to derive a final formula for classifying dyes for levelness. We do, however, feel that a start has been made in the right direction and that the important factors have been isolated. We leave it for later workers to develop the data to produce a fully useful leveling coefficient.

The foregoing has been largely devoted to the discussion of the development of laboratory methods and the data assembled with those methods. Since any laboratory method is only useful when it can be correlated with mill practice, the following section is devoted to our results on the development of such correlation.

The figures given in Appendix I are relative only at the time-temperature cycle given for that table, and, since other dyeing cycles and dyebath conditions will exist under practical mill use, it was thought essential to the work that samples of mill runs should be evaluated in the laboratory. To this end some of our committee collected samples and complete data concerning temperature and dyebath conditions for several regular mill runs. These were forwarded to the laboratory for spectrophotometric measurement, and curves were derived from the figures so obtained. An attempt at laboratory duplication of the curve was then made with the piece goods or yarn furnished by the mill.

MILL CORRELATION——One of the important factors in an attempt to duplicate in a laboratory the dyeing curves obtained from mill work is the control sample used for measuring the color in the dyebath. It is common practice in laboratories to enter the material to be dyed into a beaker containing the dye. This sequence is reversed in mill dyeing, the material to be dyed being entered and the dye withheld until the material is thoroughly wet out with water and dyebath assistants.

It will be readily apparent that this will have a considerable bearing on the control sample on which the whole curve depends. Some time will have elapsed between the addition of the dye solution to the machine and the point where the dye is thoroughly distributed throughout the machine, during which time some dyebath exhaustion has occurred. It is important, therefore, that the laboratory control sample should be the same strength as the mill control before proceeding further with the attempt at duplication. A too strong laboratory control sample is indicative of too short a period between the entry of the material to be dyed and the taking of the control sample.

Chart IX represents a mill dyeing made on wool yarn in a Hussong machine, compared with the first laboratory attempt at duplication, and our final result.

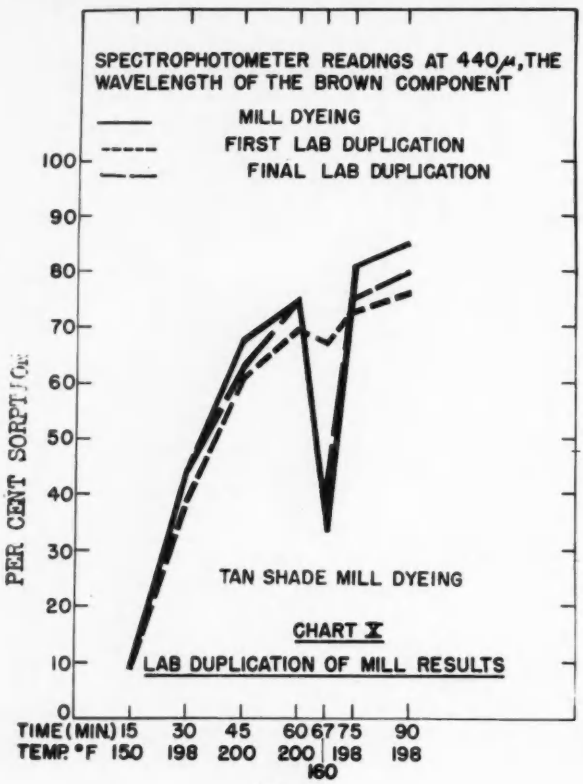

SPECTROPHOTOMETER READINGS AT 440μ, THE WAVELENGTH OF THE BROWN COMPONENT
MILL DYEING
FIRST LAB DUPLICATION
FINAL LAB DUPLICATION
PER CENT SORPTION
TAN SHADE MILL DYEING
CHART X
LAB DUPLICATION OF MILL RESULTS
TIME (MIN.) 15 30 45 60 67 75 90
TEMP. °F 150 198 200 200 198 198
160

Chart X

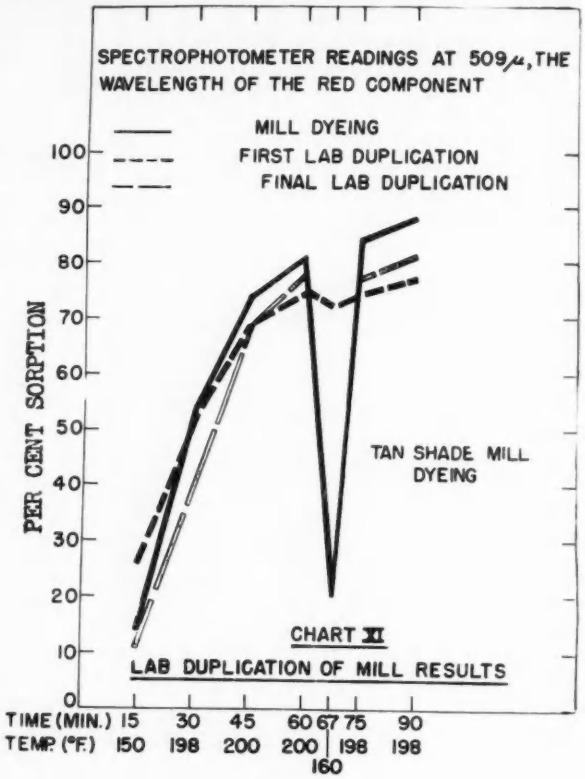

SPECTROPHOTOMETER READINGS AT 509μ, THE WAVELENGTH OF THE RED COMPONENT
MILL DYEING
FIRST LAB DUPLICATION
FINAL LAB DUPLICATION
PER CENT SORPTION
TAN SHADE MILL DYEING
CHART XI
LAB DUPLICATION OF MILL RESULTS
TIME (MIN.) 15 30 45 60 67 75 90
TEMP. (°F.) 150 198 200 200 198 198
160

Chart XI

The time-temperature cycle reported by the mill was as follows:

Minutes	5	15	30	45	60	75	90
Degrees F	161	162	162	162	180	212	212

The first laboratory attempt at duplication resulted in too steep a curve denoting excessive agitation and too complete exhaustion, especially at 60 minutes. This dyeing was agitated with a bent rod. Several trials were made with variations on the original, the final curve being the result of reduced agitation accomplished by the substitution of a straight rod for the bent rod, and lowered absorption at 60 minutes by increase of the temperature from 180 to 200° F.

Charts X and XI represent the brown and the red elements of a mix dyed on worsted packages in a Smith-Drum machine. The time-temperature cycle reported by the mill follows:

Minutes	15	30	45	60	add	75	90
Degrees F	150	198	200	200	160	198	198

The first laboratory attempt at duplication indicated that our control was too weak, noticeable especially in the red element, that our curve was slightly flat, and that the addition that was made at 67 minutes after the start failed to show sufficient value.

The final curve is the result of delaying the sampling for the control for 5 minutes after addition of the dye, of increasing the degree of agitation, of lowering the temperature to only 170 degrees for the color add, and of decreasing the elapsed time between the color add and the next sampling.

Similar results have been obtained on other mill-laboratory correlation studies, and we believe that the necessary elements are present in our method and apparatus to duplicate any mill run in the laboratory. Once the conditions have been established for duplication for any particular mill machine, it should be possible to reproduce at will in the laboratory and thus to study the characteristics of new dyes for use in that machine on a laboratory basis. The advantages of such a laboratory technique are obvious and will result in much easier, less expensive and quicker evaluation of colors in the mill.

CONCLUSIONS

In this investigation we have developed a simple, flexible laboratory technique and apparatus for evaluating the rate of exhaustion of dyestuffs, which can easily be correlated with mill practice. Data on exhaustion rates are presented for acid colors on wool, filament nylon and spun nylon.

We have also given data to explain some dyeing phenomena. The concept of some unlevelness occurring during the cooling process of dyeing acid colors on wool should be particularly useful in explaining cloudy results that have been obtained in mill piece dyeing in the past.

The concepts of leveling as presented should serve as a good foundation for the establishment of a true level-dyeing index for dyestuffs, which takes into account all of the factors affecting leveling.

REFERENCES

(1) Goodall, *J Soc Dyers Colourists* 53, 50 (1937)

(2) Kienle, Royer and McLeary, *Am Dyestuff Reptr* 34, 42 (1945)

(3) Briggs and Bull, *J Phys Chem*, 845 (1922); Hirst, *J Soc Dyers Colourists* 44, 163 (1928); and Goodall, *ibid* 54, 46 (1938)

(4) Rendell and Thomas, *J Soc Dyers Colourists* (1935)

(5) Speakman and Clegg, *J Soc Dyers Colourists* (1934); Briggs and Bull, *Dyer*, 341 (1948); Lister, *J Soc Dyers Colourists* (1949); and Leonard, *Textile Research J* (1949)

APPENDIX I

ACID COLORS ON WOOL YARN SORPTION

Dye	Dye %	Method	mμ	Time in Minutes 5	20	35	50	65	80	95	110	125
				Temperature °F 80	110	140	170	200	206	206	170	140
				Per Cent Sorption								
Du Pont Azo Yellow Conc	1.0	neutral	430	28	38	42	39	22	10	10	27	40
		acetic	430	65	82	82	76	58	57	55	67	76
		sulfuric	430	83	95	91	85	68	67	67	74	80
Du Pont Metanil Yellow Conc	1.0	neutral	440	15	24	26	22	15	13	13	17	25
		acetic	440	72	90	90	87	82	82	82	89	93
		sulfuric	440	91	97	97	95	93	93	94	96	98
Du Pont Milling Yellow 5G Conc	1.0	neutral	430	12	13	14	18	19	18	20	24	31
		acetic	430	34	67	91	95	96	96	96	98	99
		sulfuric	430	42	82	98	98	98	98	99	99	99
Du Pont Milling Yellow GN Conc 250%	1.0	neutral	425	2	2	4	7	11	17	21	25	27
		acetic	425	12	19	28	58	87	97	98	98	99
		sulfuric	425	11	17	31	69	98	99	99	99	99
Du Pont Milling Yellow R Conc	1.0	neutral	430	10	7	11	18	35	48	59	63	66
		acetic	430	30	38	51	94	99	99	100	100	100
		sulfuric	430	23	33	61	99	99	99	99	99	100
Du Pont Neutral Yellow GS	1.0	neutral	430	22	53	74	78	78	79	80	84	87
		acetic	430	35	73	93	96	96	97	97	98	99
		sulfuric	430	50	83	97	98	98	98	98	99	99
Du Pont Quinoline Yellow Conc	1.0	neutral	425					No affinity				
		acetic	425	33	70	79	73	62	62	62	77	84
		sulfuric	425	75	95	94	91	84	83	84	91	95
Du Pont Tartrazine Conc	1.0	neutral	425					No affinity				
		acetic	425	20	49	75	85	83	83	84	88	93
		sulfuric	425	63	99	99	99	99	99	99	99	100
Pontacyl Light Yellow GG Conc 125%	1.0	neutral	430					No affinity				
		acetic	430	30	65	86	90	87	86	89	92	95
		sulfuric	430	60	95	96	95	95	95	96	97	98
Pontacyl Light Yellow 3G Conc 150%	1.0	neutral	415					No affinity				
		acetic	415	24	52	77	85	83	82	83	87	92
		sulfuric	415	59	92	96	96	95	95	95	97	98
Pontacyl Light Yellow GX	1.0	neutral	430					No affinity				
		acetic	430	17	26	45	62	67	67	67	76	80
		sulfuric	430	62	92	96	96	96	96	96	96	98
Du Pont Milling Orange R Conc	1.0	neutral	462	9	10	18	39	71	78	83	89	92
		acetic	462	13	20	38	92	98	99	99	99	100
		sulfuric	462	9	16	39	97	99	99	100	100	100
Du Pont Milling Orange RN Conc 125%	1.0	neutral	427	3	4	5	10	18	23	32	37	41
		acetic	427	10	16	26	63	82	95	98	99	99
		sulfuric	427	6	14	33	75	99	99	99	99	99
Du Pont Orange II Conc	1.0	neutral	480	7	14	18	15	11	11	11	13	19
		acetic	480	38	80	88	85	78	77	78	88	92
		sulfuric	480	62	96	97	95	93	93	94	97	98
Du Pont Orange G	1.0	neutral	478					No affinity				
		acetic	478	33	49	68	72	66	66	68	75	78
		sulfuric	478	73	95	97	96	94	94	95	96	97
Du Pont Orange RO	1.0	neutral	490	6	11	16	19	17	12	11	17	18
		acetic	490	32	73	92	91	86	86	87	94	96
		sulfuric	490	44	96	98	97	96	96	94	98	98
Du Pont Silk Orange R Extra Conc 125%	1.0	neutral	430	2	5	10	20	19	18	19	20	26
		acetic	430	18	45	86	92	89	89	91	95	97
		sulfuric	430	32	70	98	98	98	98	98	99	99
Du Pont Neutral Brown RS	1.0	neutral	455	8	10	15	30	47	54	62	67	73
		acetic	455	12	23	50	92	97	98	99	99	99
		sulfuric	455	17	25	55	97	99	99	100	100	100
Du Pont Neutral Brown 2RS	1.0	neutral	465	7	13	19	35	56	68	75	81	87
		acetic	465	14	30	63	94	99	99	99	99	100
		sulfuric	465	21	35	77	99	100	100	100	100	100
Du Pont Resorcin Brown 5G Conc 200%	1.0	neutral	435	8	8	11	17	23	26	29	35	36
		acetic	435	16	31	58	82	88	89	91	96	98
		sulfuric	435	25	50	92	98	97	97	97	99	100
Du Pont Resorcin Brown 3R	1.0	neutral	435	7	8	8	8	8	10	10	13	15
		acetic	435	5	8	15	36	65	91	95	97	99
		sulfuric	435	6	11	29	89	98	99	99	99	99
Pontacyl Fast Brown CGS	1.0	neutral	420	10	20	29	47	60	65	69	76	84
		acetic	420	36	69	72	90	95	97	99	99	100
		sulfuric	420	60	77	85	100	100	100	100	100	100
Du Pont Azo Eosine 2B	1.0	neutral	521					No affinity				
		acetic	521	24	50	75	87	88	88	89	94	96
		sulfuric	521	84	90	99	100	99	99	99	100	100
Du Pont Azo Eosine G	1.0	neutral	500	7	14	18	15	11	9	8	11	18
		acetic	500	57	85	90	87	81	79	79	90	93
		sulfuric	500	82	95	96	95	99	99	99	100	100
Du Pont Rhodamine B Extra	0.5	neutral	552	20	45	61	65	59	56	56	65	74
		acetic	552	34	40	59	65	57	55	56	63	73
		sulfuric	552	14	36	52	57	49	49	49	57	67
Du Pont Rhodamine 6GDN Extra	0.5	neutral	526	69	93	94	94	92	92	92	94	96
		acetic	526	19	32	42	47	42	38	40	45	53
		sulfuric	526	4	11	18	21	17	15	19	21	27
Du Pont Anthraquinone Rubine B Conc	1.0	neutral	526	2	6	10	15	18	18	17	20	24
		acetic	526	27	47	88	92	89	88	88	94	97
		sulfuric	526	54	99	98	98	97	97	97	98	99
Du Pont Crocein Scarlet N Extra	1.0	neutral	508					No affinity				
		acetic	508	22	61	87	94	94	93	94	96	98
		sulfuric	508	50	98	99	99	99	99	99	100	100
Du Pont Milling Red B Conc	1.0	neutral	485	9	15	26	36	61	74	82	88	92
		acetic	485	13	23	59	85	99	100	100	100	100
		sulfuric	485	17	27	66	99	100	100	100	100	100
Du Pont Milling Red 3B Conc	1.0	neutral	525	6	11	13	25	61	76	82	85	87
		acetic	525	13	19	27	68	97	98	98	98	99
		sulfuric	525	11	17	30	87	100	100	100	100	100
Du Pont Milling Red R Conc	1.0	neutral	510	6	8	25	37	53	70	76	82	91
		acetic	510	9	15	66	92	100	100	100	100	100
		sulfuric	510	16	22	78	96	96	97	97	100	100
Du Pont Milling Red SWB Conc 125%	1.0	neutral	517	12	18	28	40	57	69	75	81	86
		acetic	517	18	39	65	92	96	97	98	99	100
		sulfuric	517	23	32	72	98	100	100	100	100	100
Du Pont Milling Red SWG Conc 125%	1.0	neutral	506	22	19	30	41	55	68	76	86	91
		acetic	506	23	34	76	99	100	100	100	100	100
		sulfuric	506	30	50	88	100	100	100	100	100	100

APPENDIX I—ACID COLORS ON WOOL YARN SORPTION (*Continued*)

Dye	Dye %	Method	mμ	Time in Minutes: 5	20	35	50	65	80	95	110	125
				Temperature °F: 80	110	140	170	200	206	206	170	140
				Per Cent Sorption								
Pontacyl Carmine 2B	1.0	neutral	525					No affinity				
		acetic	525	27	63	82	87	85	84	85	93	96
		sulfuric	525	67	97	98	98	97	100	97	99	100
Pontacyl Carmine 6B Extra Conc 125%	1.0	neutral	526					No affinity				
		acetic	526	19	51	60	78	76	75	77	85	89
		sulfuric	526	53	95	96	96	94	94	95	97	98
Pontacyl Carmine 2G Conc 150%	1.0	neutral	620					No affinity				
		acetic	620	24	59	76	76	79	78	78	86	90
		sulfuric	620	65	95	96	96	95	95	96	98	98
Pontacyl Fast Red AS Extra Conc	1.0	neutral	504	7	15	27	37	32	29	31	39	51
		acetic	504	27	80	97	98	96	95	96	98	99
		sulfuric	504	34	96	99	99	99	98	99	99	100
Pontacyl Light Red 4BL Conc 175%	1.0	neutral	515					No affinity				
		acetic	515	36	72	87	87	87	81	82	88	94
		sulfuric	515	66	96	97	97	96	96	96	98	99
Pontacyl Light Red BLX	1.0	neutral	570					No affinity				
		acetic	570	32	69	84	85	79	78	80	88	94
		sulfuric	570	75	97	97	97	95	95	95	97	99
Pontacyl Light Scarlet EG	1.0	neutral	570					No affinity				
		acetic	570	25	55	69	74	70	69	70	76	83
		sulfuric	570	75	94	95	94	93	93	93	95	96
Pontacyl Rubine R Extra Conc 125%	1.0	neutral	513					No affinity				
		acetic	513	36	72	92	94	93	92	92	96	98
		sulfuric	513	61	99	99	99	99	99	99	99	100
Pontacyl Ruby PL Extra Conc 200%	1.0	neutral	505	11	20	27	28	23	21	21	28	39
		acetic	505	51	80	90	90	88	86	86	93	96
		sulfuric	505	54	95	96	96	94	94	94	95	98
Pontacyl Scarlet R Conc	1.0	neutral	507	2	2	3	4	12	18	24	28	30
		acetic	507	13	16	37	89	100	100	100	100	100
		sulfuric	507	14	19	41	99	100	100	100	100	100
Du Pont Anthraquinone Violet R	1.0	neutral	550	6	9	11	14	19	20	22	28	32
		acetic	550	17	36	70	97	99	99	99	99	99
		sulfuric	550	23	47	96	100	100	100	100	100	100
Du Pont Anthraquinone Violet 3R	1.0	neutral	555	6	8	9	12	16	17	19	21	23
		acetic	555	17	35	71	96	98	98	98	99	99
		sulfuric	555	25	57	95	99	99	100	99	99	100
Pontacyl Fast Violet 10B Conc 175%	1.0	neutral	575	5	8	11	13	15	13	13	13	15
		acetic	575	15	30	42	57	64	66	68	75	77
		sulfuric	575	26	56	73	81	82	82	82	90	94
Pontacyl Fast Violet VR	1.0	neutral	530	9	14	15	19	24	24	25	28	32
		acetic	530	10	33	52	76	87	90	91	95	97
		sulfuric	530	23	47	79	91	93	94	95	97	98
Pontacyl Violet 4BL Conc 125%	1.0	neutral	545	5	11	13	19	27	31	33	40	48
		acetic	545	15	32	53	79	89	92	93	97	98
		sulfuric	545	19	43	82	95	95	96	96	97	98
Pontacyl Violet 4BSN Conc 125%	1.0	neutral	510	12	13	14	14	15	12	10	9	8
		acetic	510	26	59	75	78	75	74	75	84	89
		sulfuric	510	71	84	91	95	95	95	95	97	97
Pontacyl Violet C4BN	1.0	neutral	550	6	9	12	18	32	42	48	55	50
		acetic	550	9	21	41	85	96	98	98	99	100
		sulfuric	550	14	34	78	98	99	99	99	99	99
Pontacyl Violet RL	1.0	neutral	545					No affinity				
		acetic	545	35	73	89	92	88	88	89	94	97
		sulfuric	545	62	97	98	98	97	97	97	98	98
Pontacyl Violet 6R Conc 150%	1.0	neutral	541	7	8	8	10	11	9	7	7	7
		acetic	541	30	66	91	95	94	95	95	98	99
		sulfuric	541	57	97	99	99	99	99	99	99	100
Pontacyl Violet S4B	1.0	neutral	544	4	12	14	20	23	39	43	47	52
		acetic	544	16	34	62	91	95	96	97	98	99
		sulfuric	544	16	46	86	98	97	98	98	98	99
Du Pont Anthraquinone Blue AB	1.0	neutral	642	8	16	23	27	23	23	24	34	44
		acetic	642	47	83	90	91	87	88	89	95	97
		sulfuric	642	79	97	97	97	95	95	95	98	98
Du Pont Anthraquinone Blue B	1.0	neutral	600					No affinity				
		acetic	600	19	45	70	78	74	74	77	83	92
		sulfuric	600	57	98	98	97	96	96	96	99	99
Du Pont Anthraquinone Blue BGA	1.0	neutral	630	7	11	14	16	17	19	20	21	25
		acetic	630	24	52	63	70	71	72	75	79	86
		sulfuric	630	34	75	83	85	83	83	85	88	93
Du Pont Anthraquinone Blue BN	1.0	neutral	600					No affinity				
		acetic	600	32	65	80	81	74	73	74	85	91
		sulfuric	600	80	98	98	97	95	94	96	98	99
Du Pont Anthraquinone Blue 2GA	1.0	neutral	624	7	16	24	26	19	18	19	26	38
		acetic	624	67	89	92	90	84	86	86	93	97
		sulfuric	624	87	97	97	96	94	94	94	97	99
Du Pont Anthraquinone Blue 3G	1.0	neutral	600					No affinity				
		acetic	600	17	43	79	93	93	94	94	98	99
		sulfuric	600	39	95	97	100	100	100	100	100	100
Du Pont Anthraquinone Blue 4GL	1.0	neutral	645					No affinity				
		acetic	645	35	65	81	82	83	84	85	90	95
		sulfuric	645	81	96	96	96	96	96	96	98	98
Du Pont Anthraquinone Blue RA	1.0	neutral	603	13	25	31	32	24	22	22	30	41
		acetic	603	72	92	92	91	86	87	87	95	97
		sulfuric	603	86	97	97	96	94	94	94	97	98
Du Pont Anthraquinone Blue RXO	1.0	neutral	611	7	13	17	23	21	21	21	26	34
		acetic	611	31	66	85	90	89	88	90	95	97
		sulfuric	611	46	91	96	96	95	95	96	98	99
Du Pont Anthraquinone Blue SEN	1.0	neutral	591					No affinity				
		acetic	591	26	59	75	78	72	72	72	86	91
		sulfuric	591	46	91	96	96	95	95	96	98	99
Du Pont Anthraquinone Blue SKY	1.0	neutral	591	11	23	32	42	38	39	41	53	60
		acetic	591	30	81	94	95	95	94	94	98	98
		sulfuric	591	39	96	98	98	98	98	98	98	99
Du Pont Anthraquinone Blue SWB	1.0	neutral	601	7	11	16	18	16	13	11	14	18
		acetic	601	42	77	86	85	80	78	79	87	92
		sulfuric	601	77	96	96	96	94	94	94	96	98
Du Pont Anthraquinone Blue SWF Conc 150%	1.0	neutral	601	17	35	45	43	32	28	29	43	60
		acetic	601	59	94	96	95	91	90	91	96	98
		sulfuric	601	78	99	99	98	97	97	97	98	99
Du Pont Anthraquinone Blue WSA	1.0	neutral	575	8	15	21	25	21	19	20	29	37
		acetic	575	32	73	90	90	85	85	85	92	93
		sulfuric	575	47	94	97	96	95	95	94	97	99
Du Pont Anthraquinone Iris R	1.0	neutral	550					No affinity				
		acetic	550	28	57	73	76	70	68	69	81	98
		sulfuric	550	63	94	94	95	95	95	92	97	99

APPENDIX I—ACID COLORS ON WOOL YARN SORPTION (*Concluded*)

Dye	Dye %	Method	mμ	Time in Minutes 5	20	35	50	65	80	95	110	125
				Temperature °F 80	110	140	170	200	206	206	170	140
				Per Cent Sorption								
Du Pont Brilliant Milling Blue B Conc 200%	1.0	neutral	550	6	7	10	20	35	55	53	60	63
		acetic	550	22	24	45	85	93	95	97	99	99
		sulfuric	550	27	46	82	95	97	97	97	98	98
Du Pont Indigotine Conc	1.0	neutral	645	9	17	17	17	19	19	17	17	16
		acetic	645	20	43	63	63	59	57	59	70	78
		sulfuric	645	63	92	94	91	89	89	89	93	96
Pontacyl Brilliant Blue A Conc	1.0	neutral	645	0	2	2	7	8	10	10	14	16
		acetic	645	6	15	29	56	71	73	75	84	90
		sulfuric	645	7	24	74	82	86	87	88	95	98
Pontacyl Brilliant Blue E	1.0	neutral	645					No affinity				
		acetic	645	2	4	8	19	36	41	48	54	62
		sulfuric	645	5	14	49	80	87	87	89	94	97
Pontacyl Brilliant Blue RR Conc 200%	1.0	neutral	575	11	11	15	22	33	45	53	67	67
		acetic	575	16	21	43	77	90	93	95	99	99
		sulfuric	575	31	42	76	93	95	95	96	99	99
Pontacyl Brilliant Blue V	1.0	neutral	645					No affinity				
		acetic	645	10	21	32	42	52	56	58	63	69
		sulfuric	645	20	56	72	76	75	74	76	81	86
Pontacyl Fast Blue GB Extra Conc 125%	1.0	neutral	550	4	10	17	35	62	77	82	91	93
		acetic	550	6	13	42	94	96	98	98	98	99
		sulfuric	550	8	11	27	96	98	99	98	100	99
Pontacyl Fast Blue R	1.0	neutral	525					No affinity				
		acetic	525	13	28	54	89	96	97	97	99	99
		sulfuric	525	20	58	97	99	98	99	99	99	99
Pontacyl Fast Blue 5R Conc	1.0	neutral	530	5	10	16	30	50	63	67	75	75
		acetic	530	8	21	44	96	97	97	98	98	100
		sulfuric	530	8	15	33	96	97	98	99	98	99
Pontacyl Fast Blue SB Conc 150%	1.0	neutral	552	6	9	11	9	10	11	11	17	15
		acetic	552	12	29	53	88	96	98	98	99	99
		sulfuric	552	30	60	97	98	98	99	99	100	100
Pontacyl Navy Blue M4B Conc 200%	1.0	neutral	550	1	2	4	17	21	62	71	81	86
		acetic	550	6	13	29	73	100	100	100	100	100
		sulfuric	550	3	10	33	99	100	100	100	100	100
Pontacyl Wool Blue BL Conc 200%	0.5	neutral	574	14	24	28	38	52	53	57	64	75
		acetic	574	20	36	69	94	96	96	97	98	98
		sulfuric	574	14	30	82	97	97	97	98	98	99
Pontacyl Wool Blue GL Conc 250%	1.0	neutral	575	11	12	23	37	48	57	59	73	77
		acetic	575	15	34	58	92	94	96	97	98	99
		sulfuric	575	15	30	63	93	94	95	95	99	99
Du Pont Anthraquinone Green G	1.0	neutral	645	9	15	18	22	26	28	29	33	36
		acetic	645	17	35	75	94	96	97	97	99	100
		sulfuric	645	22	48	97	100	100	100	100	100	100
Du Pont Anthraquinone Green GN	1.0	neutral	638	13	23	31	38	42	43	45	50	53
		acetic	638	22	38	75	100	100	100	100	100	100
		sulfuric	638	23	43	100	100	100	100	100	100	100
Du Pont Brilliant Milling Green B Conc	1.0	neutral	645	0	2	4	12	15	17	21	27	32
		acetic	645	5	25	52	75	82	84	85	90	94
		sulfuric	645	17	44	85	92	92	94	94	93	97
Du Pont Naphthol Green B Extra Conc 125%	1.0	neutral	645					No affinity				
		acetic	645	9	15	27	56	87	97	97	98	100
		sulfuric	645	40	67	73	90	93	94	92	94	100
Pontacyl Dark Green B Conc 175%	1.0	neutral	575					No affinity				
		acetic	575	13	37	79	95	96	96	96	100	100
		sulfuric	575	30	75	100	100	100	100	100	100	100
Pontacyl Dark Green G Conc 175%	0.5	neutral	575					No affinity				
		acetic	575	26	62	87	93	95	93	93	95	96
		sulfuric	575	59	89	95	97	94	95	96	96	98
Pontacyl Green BL Extra Conc 200%	0.5	neutral	610	4	6	6	8	10	12	15	17	17
		acetic	610	21	26	50	73	76	78	80	87	93
		sulfuric	610	20	27	84	88	86	87	87	94	96
Pontacyl Green NV Extra	0.5	neutral	610	5	9	10	12	12	12	12	14	19
		acetic	610	15	31	58	57	62	64	66	72	82
		sulfuric	610	23	58	71	78	78	79	82	88	93
Pontacyl Green SN Extra	1.0	neutral	645	0	0	0	0	0	0	8	8	12
		acetic	645	8	24	37	51	52	51	55	56	77
		sulfuric	645	29	56	68	75	72	72	75	85	91
Du Pont Neutral Gray L	1.0	neutral	645	2	2	3	10	22	33	37	41	41
		acetic	645	13	22	46	85	98	100	100	100	100
		sulfuric	645	23	39	97	98	100	100	100	100	100
Du Pont Naphthylamine Black V Conc 125%	3.2	neutral	550	0	0	4	8	16	26	37	42	47
		acetic	550	10	13	24	63	86	92	93	96	96
		sulfuric	550	8	10	19	57	94	99	98	100	100
Pontacyl Black BX	4.0	neutral	610	3	4	6	9	10	9	9	9	11
		acetic	610	4	10	26	85	87	88	88	92	95
		sulfuric	610	5	11	42	97	97	98	98	98	98
Pontacyl Black GRF Conc 125%	3.2	neutral	575	3	3	4	8	9	9	9	9	11
		acetic	575	6	11	25	76	82	94	94	95	96
		sulfuric	575	7	17	36	93	98	93	98	98	93
Pontacyl Blue Black RC	4.0	neutral	575					No affinity				
		acetic	575	10	17	25	49	69	73	75	84	86
		sulfuric	575	14	24	49	97	99	98	96	97	99
Pontacyl Blue Black SX	4.0	neutral	610					No affinity				
		acetic	610	7	15	31	70	90	91	92	96	97
		sulfuric	610	7	17	40	97	99	99	99	99	99
Pontacyl Blue Black SXR	4.0	neutral	610					No affinity				
		acetic	610	6	15	28	71	86	88	91	96	98
		sulfuric	610	9	12	57	99	99	100	100	100	100
Pontacyl Fast Black BBN	4.0	neutral	410	5	8	10	17	32	47	55	60	62
		acetic	410	10	17	22	33	76	85	89	91	93
		sulfuric	410	11	17	23	45	87	97	98	99	99
Pontacyl Fast Black BBO	4.0	neutral	410	4	12	17	22	37	50	55	64	65
		acetic	410	12	22	31	51	79	86	89	92	93
		sulfuric	410	17	23	33	51	85	95	98	98	98
Pontacyl Fast Black N2B Conc 200%	3.0	neutral	575	5	7	7	11	26	33	47	57	62
		acetic	575	3	9	11	35	96	98	98	98	100
		sulfuric	575	2	3	13	59	98	98	98	98	100

APPENDIX II

ACID COLORS ON BRIGHT NYLON FILAMENT YARN SORPTION

Dye	Dye %	Method	mμ	Time in Minutes 5	20	35	50	65	80	95	110	125
				Temperature °F 80	110	140	170	200	206	206	170	140
								Per Cent Sorption				
Du Pont Azo Yellow Conc	1.0	neutral	435	8	19	32	43	49	49	51	52	62
		amm acet	435	10	25	44	65	73	75	77	83	88
		acetic	435	8	24	55	84	85	85	87	88	90
Du Pont Metanil Yellow Conc	1.0	neutral	435	13	13	21	30	36	38	36	40	40
		amm acet	435	7	24	42	69	71	83	85	88	91
		acetic	435	5	23	55	89	97	98	99	99	99
Du Pont Milling Yellow 5G Conc	1.0	neutral	435	17	26	36	40	64	64	69	70	70
		amm acet	435	0	10	32	60	88	91	91	95	95
		acetic	435	14	24	44	78	97	98	98	96	96
Du Pont Milling Yellow GN Conc 250%	1.0	neutral	435	0	2	2	2	30	39	42	43	43
		amm acet	435	3	3	5	23	52	62	64	65	64
		acetic	435	1	1	4	33	72	78	82	82	74
Du Pont Milling Yellow R Conc	1.0	neutral	435	3	5	8	20	38	52	57	57	51
		amm acet	435	5	5	9	32	55	72	73	76	76
		acetic	435	0	0	7	35	72	90	95	96	80
Du Pont Neutral Yellow GS	1.0	neutral	435	11	22	49	71	80	84	78	86	86
		amm acet	435	15	27	64	80	85	89	89	90	90
		acetic	435	14	32	68	79	90	92	93	94	93
Du Pont Quinoline Yellow Conc	1.0	neutral	435	2	5	7	11	17	17	14	15	14
		amm acet	435	3	4	13	24	32	35	37	46	52
		acetic	435	4	9	25	39	84	89	92	93	94
Du Pont Tartrazine Conc	1.0	neutral	435					No affinity				
		amm acet	435					No affinity				
		acetic	435	0	0	2	20	56	71	72	73	74
Pontacyl Light Yellow GG Conc 125%	1.0	neutral	435					No affinity				
		amm acet	435	0	0	1	5	12	19	24	29	32
		acetic	435	3	7	21	59	92	98	98	99	100
Pontacyl Light Yellow 3G Conc 150%	1.0	neutral	435					No affinity				
		amm acet	435	0	0	1	5	13	18	20	20	22
		acetic	435	2	3	20	58	90	90	89	95	95
Pontacyl Light Yellow GX	1.0	neutral	435					No affinity				
		amm acet	435	0	2	2	5	10	13	13	15	17
		acetic	435	0	0	6	32	80	92	93	95	96
Du Pont Milling Orange R Conc	1.0	neutral	435	2	2	5	15	41	53	59	64	64
		amm acet	435	7	7	7	30	74	84	87	89	89
		acetic	435	4	9	13	34	82	95	97	98	98
Du Pont Milling Orange RN Conc 125%	1.0	neutral	435	3	4	6	9	33	36	39	44	39
		amm acet	435	0	0	3	14	44	54	58	58	60
		acetic	435	0	0	5	16	58	68	73	73	73
Du Pont Orange II Conc	1.0	neutral	435	0	3	8	13	20	20	18	13	15
		amm acet	435	1	3	20	38	49	49	50	57	66
		acetic	435	2	14	44	72	92	92	92	95	96
Du Pont Orange G	1.0	neutral	435					No affinity				
		amm acet	435	1	1	1	4	7	14	14	16	16
		acetic	435	1	3	11	39	67	71	73	75	75
Du Pont Orange RO	1.0	neutral	515	2	4	7	14	19	19	14	14	14
		amm acet	515	4	4	4	30	58	62	63	69	77
		acetic	515	2	4	22	60	86	89	90	94	96
Du Pont Silk Orange R Ex. Conc 125%	1.0	neutral	435	0	5	9	22	38	42	43	44	46
		amm acet	435	1	7	17	42	68	76	80	86	87
		acetic	435	3	7	23	62	82	100	100	100	100
Du Pont Neutral Brown BGL	1.0	neutral	435	0	0	3	14	30	46	47	47	47
		amm acet	435	7	14	20	41	70	86	93	93	96
		acetic	435	0	0	7	42	81	92	92	92	94
Du Pont Neutral Brown RS	1.0	neutral	435	2	4	8	21	45	55	60	63	63
		amm acet	435	2	5	12	37	72	80	84	88	87
		acetic	435	0	8	18	49	89	93	96	98	99
Du Pont Neutral Brown 2RS	1.0	neutral	435	5	5	8	24	47	72	81	86	89
		amm acet	435	2	4	10	31	66	82	96	99	100
		acetic	435	5	8	15	50	98	100	100	100	100
Du Pont Resorcin Brown 5G Conc 200%	1.0	neutral	435	2	3	9	18	29	38	40	41	42
		amm acet	435	6	8	15	40	62	77	82	85	89
		acetic	435	1	1	15	49	83	95	97	97	97
Du Pont Resorcin Brown 3R	1.0	neutral	435	2	3	3	4	11	18	16	13	13
		amm acet	435	2	3	3	9	28	53	65	71	72
		acetic	435	1	3	5	14	46	93	99	100	100
Pontacyl Fast Brown CGS	1.0	neutral	435	3	4	9	26	44	67	72	76	78
		amm acet	435	5	10	24	57	87	90	90	90	90
		acetic	435	5	11	28	69	89	94	94	94	94
Du Pont Azo Eosine 2B	1.0	neutral	515					No affinity				
		amm acet	515					No affinity				
		acetic	515	0	0	0	8	43	76	88	92	92
Du Pont Azo Eosine G	1.0	neutral	515	2	5	17	32	39	41	39	40	39
		amm acet	515	3	14	36	66	82	85	87	96	99
		acetic	515	4	20	54	97	100	100	100	100	100
Du Pont Anthraquinone Rubine R Conc	1.0	neutral	515	1	2	5	13	25	31	31	33	33
		amm acet	515	1	6	13	30	64	78	83	92	96
		acetic	515	5	10	38	94	100	100	100	100	100
Du Pont Crocein Scarlet N Extra	1.0	neutral	515	0	1	1	3	8	13	13	11	11
		amm acet	515	0	4	5	13	30	45	53	58	60
		acetic	515	0	0	3	16	83	96	98	99	99
Du Pont Milling Red B Conc	1.0	neutral	550	0	1	2	7	20	34	40	42	42
		amm acet	550	3	3	3	15	39	63	75	83	85
		acetic	550	3	4	6	20	64	92	97	97	97
Du Pont Milling Red 3B Conc	1.0	neutral	550	0	0	0	4	22	36	42	47	48
		amm acet	550	0	1	2	9	41	70	81	86	86
		acetic	550	3	4	8	25	73	92	94	95	96
Du Pont Milling Red R Conc	1.0	neutral	515	0	0	2	7	19	26	31	33	36
		amm acet	515	3	4	4	14	49	80	89	93	93
		acetic	515	0	2	6	24	68	95	97	97	98
Du Pont Milling Red SWB Conc 125%	1.0	neutral	515	0	1	3	12	27	40	45	48	49
		amm acet	515	3	4	10	22	46	66	81	84	85
		acetic	515	1	4	4	24	65	89	92	92	93

APPENDIX II—ACID COLORS ON BRIGHT NYLON FILAMENT YARN SORPTION (*Continued*)

Dye	Dye %	Method	mμ	Time in Minutes 5	20	35	50	65	80	95	110	125
				Temperature °F 80	110	140	170	200	206	206	170	140
				Per Cent Sorption								
Du Pont Milling Red SWG Conc 125%	1.0	neutral	515	5	6	8	13	26	34	35	39	40
		amm acet	515	1	2	4	13	47	68	79	88	88
		acetic	515	2	3	8	19	55	80	94	97	98
Pontacyl Carmine 2B	1.0	neutral	515					No affinity				
		amm acet	515	0	4	4	7	19	25	30	33	34
		acetic	515	2	3	7	34	82	94	96	97	98
Pontacyl Carmine 6B Ex. Conc 125%	1.0	neutral	515					No affinity				
		amm acet	515					No affinity				
		acetic	515	1	3	5	18	62	88	94	95	96
Pontacyl Carmine 2G Conc 150%	1.0	neutral	515					No affinity				
		amm acet	515	3	4	4	6	13	15	18	19	20
		acetic	515	5	5	10	37	82	90	93	96	97
Pontacyl Fast Red AS Ex Conc	1.0	neutral	515	0	0	9	21	34	36	39	41	45
		amm acet	515	5	4	25	54	84	88	90	97	98
		acetic	515	0	13	27	70	74	89	96	100	100
Pontacyl Light Red 4BL Conc 175%	1.0	neutral	515					No affinity				
		amm acet	515	1	2	5	14	24	30	32	36	36
		acetic	515	1	2	9	44	85	92	93	96	97
Pontacyl Light Red BLX	1.0	neutral	515					No affinity				
		amm acet	515	1	1	3	8	15	26	31	33	36
		acetic	515	1	1	7	44	81	96	98	99	100
Pontacyl Light Scarlet EG	1.0	neutral	515					No affinity				
		amm acet	515					No affinity				
		acetic	515	2	3	4	26	77	90	92	94	95
Pontacyl Rubine R Ex Conc 125%	1.0	neutral	515	0	2	3	8	15	18	15	12	12
		amm acet	515	2	4	4	13	30	42	47	47	54
		acetic	515	0	0	11	39	72	92	94	96	97
Pontacyl Ruby PL Ex Conc 200%	1.0	neutral	515	4	7	14	32	49	58	61	68	69
		amm acet	515	2	6	20	48	74	82	87	93	95
		acetic	515	4	16	41	91	98	99	99	99	99
Pontacyl Scarlet R Conc	1.0	neutral	515	0	0	0	4	11	18	22	20	20
		amm acet	515	3	4	4	7	20	39	49	54	55
		acetic	515	0	0	3	11	54	94	98	99	99
Du Pont Anthraquinone Violet R	1.0	neutral	550	2	3	9	17	22	23	21	20	20
		amm acet	550	3	10	15	26	44	58	65	70	72
		acetic	550	2	8	20	41	86	97	98	99	99
Du Pont Anthraquinone Violet 3R	1.0	neutral	550	3	6	8	13	19	24	25	23	23
		amm acet	550	4	6	7	14	37	58	68	75	76
		acetic	550	1	4	11	28	81	97	99	100	100
Pontacyl Fast Violet 10B Conc 175%	1.0	neutral	575					No affinity				
		amm acet	575					No affinity				
		acetic	575	0	0	2	8	28	42	51	58	59
Pontacyl Fast Violet VR	1.0	neutral	515	0	0	0	3	8	11	11	11	11
		amm acet	515	3	3	3	6	19	28	33	37	37
		acetic	515	9	14	19	33	73	93	97	98	99
Pontacyl Violet 4BL Conc 125%	1.0	neutral	575					No affinity				
		amm acet	575	3	3	3	4	9	12	12	13	13
		acetic	575	0	0	0	14	67	70	79	84	86
Pontacyl Violet 4BSN Conc 125%	1.0	neutral	550	1	3	3	6	11	15	11	9	9
		amm acet	550	1	1	1	6	12	19	19	21	23
		acetic	550	1	2	7	25	71	92	95	96	96
Pontacyl Violet C4BN	1.0	neutral	550	0	2	2	3	6	11	10	8	7
		amm acet	550	3	3	3	3	9	13	14	15	15
		acetic	550	3	3	6	17	50	79	92	96	97
Pontacyl Violet RL	1.0	neutral	525	0	1	1	1	2	10	7	4	4
		amm acet	525	1	1	1	7	26	37	45	55	56
		acetic	525	1	1	10	44	94	96	97	98	98
Pontacyl Violet 6R Conc 150%	1.0	neutral	550					No affinity				
		amm acet	550	0	0	3	10	32	46	53	54	59
		acetic	550	0	0	7	43	91	97	98	98	98
Pontacyl Violet S4B	1.0	neutral	550	0	1	3	3	6	8	10	7	6
		amm acet	550	1	1	2	3	8	7	7	8	10
		acetic	550	2	4	6	17	54	78	87	90	91
Du Pont Anthraquinone Blue AB	1.0	neutral	645	1	3	13	28	44	50	50	54	55
		amm acet	645	3	8	30	58	80	85	89	94	97
		acetic	645	4	17	63	98	100	100	100	100	100
Du Pont Anthraquinone Blue B	1.0	neutral	575					No affinity				
		amm acet	575	0	0	0	3	4	6	7	9	10
		acetic	575	0	0	6	30	79	95	97	98	99
Du Pont Anthraquinone Blue BGA	1.0	neutral	645	1	1	5	11	17	18	17	17	16
		amm acet	645	2	3	10	19	25	26	27	27	28
		acetic	645	1	3	13	21	55	70	76	82	84
Du Pont Anthraquinone Blue BN	1.0	neutral	575					No affinity				
		amm acet	575	2	2	2	2	5	7	7	12	12
		acetic	575	2	2	9	37	41	98	98	99	99
Du Pont Anthraquinone Blue 2GA	1.0	neutral	645	3	9	28	50	60	63	63	70	75
		amm acet	645	3	14	46	74	86	87	90	96	98
		acetic	645	4	25	80	98	100	100	100	100	100
Du Pont Anthraquinone Blue 3G	1.0	neutral	645	0	0	2	8	12	18	15	14	13
		amm acet	645	1	2	4	15	38	53	61	70	72
		acetic	645	1	3	13	49	98	99	100	100	100
Du Pont Anthraquinone Blue 4GL	1.0	neutral	645					no affinity				
		amm acet	645	0	3	3	15	35	52	58	66	71
		acetic	645	0	0	3	29	86	100	100	100	100
Du Pont Anthraquinone Blue RA	1.0	neutral	645	2	13	31	54	64	67	67	73	81
		amm acet	645	5	19	40	75	86	89	91	97	98
		acetic	645	5	26	71	78	98	98	99	100	100
Du Pont Anthraquinone Blue RXO	1.0	neutral	645	1	5	13	28	42	45	46	47	50
		amm acet	645	2	5	19	47	72	80	85	91	93
		acetic	645	3	8	32	80	91	93	93	100	100
Du Pont Anthraquinone Blue SEN	1.0	neutral	645					No affinity				
		amm acet	645	2	3	5	8	14	17	18	21	22
		acetic	645	3	6	16	50	94	96	97	98	100
Du Pont Anthraquinone Blue SKY	1.0	neutral	575	2	5	13	28	45	52	55	60	62
		amm acet	575	3	9	27	59	74	89	93	97	98
		acetic	575	6	15	50	76	94	98	98	99	99
Du Pont Anthraquinone Blue SWB	1.0	neutral	575	2	3	9	19	25	27	26	26	28
		amm acet	575	0	9	22	38	45	50	52	55	57
		acetic	575	4	16	44	78	100	100	100	100	100
Du Pont Anthraquinone Blue SWF Conc 150%	1.0	neutral	575	3	12	28	47	62	65	65	70	75
		amm acet	575	7	27	60	89	93	93	95	98	98
		acetic	575	8	36	82	99	100	100	100	100	100

APPENDIX II—ACID COLORS ON BRIGHT NYLON FILAMENT YARN SORPTION (*Concluded*)

Dye	Dye %	Method	mμ	Time in Minutes 5	20	35	50	65	80	95	110	125
				Temperature °F 80	110	140	170	200	206	206	170	140
								Per Cent Sorption				
Du Pont Anthraquinone Blue WSA	1.0	neutral	575					No affinity				
		amm acet	575	0	0	0	2	3	5	8	10	13
		acetic	575	2	3	10	38	86	97	98	99	100
Du Pont Anthraquinone Iris R	1.0	neutral	550	0	0	1	7	13	15	13	13	15
		amm acet	550	2	8	22	47	68	74	78	81	87
		acetic	550	3	14	44	81	97	99	99	99	100
Du Pont Brilliant Milling Blue B Conc 200%	1.0	neutral	550	1	1	1	6	9	18	20	20	20
		amm acet	550	1	1	1	6	11	20	23	26	28
		acetic	550	3	3	7	27	71	94	97	98	99
Du Pont Indigotine Conc	1.0	neutral	645					No affinity				
		amm acet	645	0	0	0	4	8	13	16	18	18
		acetic	645	0	3	9	37	76	89	89	93	95
Pontacyl Brilliant Blue A Conc	1.0	neutral	645					No affinity				
		amm acet	645	0	4	4	5	8	13	13	17	17
		acetic	645	0	0	2	16	43	74	84	89	92
Pontacyl Brilliant Blue E	1.0	neutral	645					No affinity				
		amm acet	645					No affinity				
		acetic	645	3	3	3	4	7	5	25	41	43
Pontacyl Brilliant Blue RR Conc 200%	1.0	neutral	575	1	2	4	5	10	15	17	17	17
		amm acet	575	3	4	5	5	11	16	19	20	23
		acetic	575	3	4	5	15	44	74	86	90	92
Pontacyl Brilliant Blue V	1.0	neutral	645					No affinity				
		amm acet	645					No affinity				
		acetic	645	1	1	1	4	13	30	42	48	49
Pontacyl Fast Blue GB Ex Conc 125%	1.0	neutral	550	0	1	6	22	46	64	76	82	82
		amm acet	550	1	4	11	43	83	96	98	98	98
		acetic	550	2	5	7	23	72	90	99	100	100
Pontacyl Fast Blue R	1.0	neutral	550					No affinity				
		amm acet	550	0	3	3	8	22	36	46	51	54
		acetic	550	0	2	4	18	58	86	90	92	94
Pontacyl Fast Blue 5R Conc	1.0	neutral	550	2	2	7	16	33	46	51	55	58
		amm acet	550	2	5	13	37	70	85	93	97	97
		acetic	550	5	5	10	20	65	92	98	98	99
Pontacyl Fast Blue SB Conc 150%	1.0	neutral	575	0	2	2	3	6	16	10	9	9
		amm acet	575	2	2	2	8	23	40	51	56	57
		acetic	575	1	2	4	20	65	94	98	99	99
Pontacyl Navy Blue M4B Conc 200%	1.0	neutral	550	1	3	5	12	30	43	49	51	52
		amm acet	550	0	3	4	17	48	78	94	98	99
		acetic	550	1	3	5	20	63	96	100	100	100
Pontacyl Wool Blue BL Conc 200%	1.0	neutral	575	2	3	6	21	37	47	52	54	56
		amm acet	575	3	4	12	38	70	87	93	96	98
		acetic	575	3	6	17	58	97	99	100	100	100
Pontacyl Wool Blue GL Conc 250%	1.0	neutral	575	0	2	5	17	33	43	48	50	51
		amm acet	575	3	3	8	27	51	69	77	84	85
		acetic	575	4	5	10	44	88	96	98	98	99
Du Pont Anthraquinone Green G	1.0	neutral	645	1	5	5	16	20	21	18	17	17
		amm acet	645	2	5	15	24	37	53	60	64	66
		acetic	645	3	7	18	36	77	93	95	97	98
Du Pont Anthraquinone Green GN	1.0	neutral	645	4	5	13	28	40	38	41	41	42
		amm acet	645	4	5	7	17	47	58	62	66	69
		acetic	645	5	7	22	51	94	98	98	99	98
Du Pont Brilliant Milling Green B Conc	1.0	neutral	645					No affinity				
		amm acet	645	1	2	4	5	9	15	17	19	20
		acetic	645	1	2	4	5	39	64	77	83	87
Du Pont Naphthol Green B Ex Conc 125%	1.0	neutral	645					No affinity				
		amm acet	645					No affinity				
		acetic	645	2	6	20	46	67	71	78	76	72
Pontacyl Dark Green B Conc 175%	1.0	neutral	575	0	0	2	6	11	16	16	14	13
		amm acet	575	0	0	2	9	21	39	51	57	57
		acetic	575	1	3	6	53	57	71	88	100	100
Pontacyl Dark Green G Conc 175%	1.0	neutral	575	0	0	1	2	9	15	18	17	18
		amm acet	575	0	2	3	9	25	41	53	57	60
		acetic	575	0	3	6	19	59	92	98	99	99
Pontacyl Green BL Ex Conc 200%	1.0	neutral	645					No affinity				
		amm acet	645	1	2	3	5	9	17	22	26	26
		acetic	645	1	2	4	13	43	72	84	88	91
Pontacyl Green NV Ex	1.0	neutral	645					No affinity				
		amm acet	645					No affinity				
		acetic	645	1	2	4	12	29	46	57	62	65
Pontacyl Green SN Ex	1.0	neutral	645					No affinity				
		amm acet	645					No affinity				
		acetic	645	0	1	3	14	40	60	66	72	74
Du Pont Neutral Gray L	1.0	neutral	645	1	3	11	31	54	63	65	66	68
		amm acet	645	3	8	18	45	72	87	90	92	92
		acetic	645	4	10	31	70	88	92	92	92	92
Du Pont Naphthylamine Black V Conc 125%	4.0	neutral	515	1	1	5	8	17	18	19	20	23
		amm acet	515	0	4	9	19	45	57	64	67	69
		acetic	515	3	5	13	23	48	68	71	72	75
Pontacyl Black GRF Conc 125%	4.0	neutral	575					No affinity				
		amm acet	575	1	2	2	5	16	27	35	37	37
		acetic	575	0	2	3	7	29	55	60	60	60
Pontacyl Blue Black RC	4.0	neutral	575					No affinity				
		amm acet	575					No affinity				
		acetic	575	2	2	3	5	10	14	16	15	14
Pontacyl Blue Black SX	4.0	neutral	575					No affinity				
		amm acet	575	1	1	3	4	14	23	25	27	27
		acetic	575	2	3	4	11	28	43	43	43	43
Pontacyl Blue Black SXR	4.0	neutral	575					No affinity				
		amm acet	575	0	1	1	4	8	13	15	15	15
		acetic	575	2	2	3	8	20	33	36	36	36
Pontacyl Fast Black BBN	4.0	neutral	550	5	6	7	11	20	27	30	30	35
		amm acet	550	1	1	4	14	32	54	64	68	72
		acetic	550	0	3	3	12	43	70	76	80	82
Pontacyl Fast Black BBO	4.0	neutral	550	1	4	7	11	23	34	40	44	44
		amm acet	550	0	1	4	15	28	46	55	57	61
		acetic	550	2	8	8	17	35	57	65	69	69
Pontacyl Fast Black N2B Conc 200%	4.0	neutral	550					No affinity				
		amm acet	550	2	3	4	10	27	41	52	55	55
		acetic	550	2	2	4	13	32	45	51	54	55

APPENDIX III

RATE OF ABSORPTION OF ACID DYES ON SPUN NYLON YARN

Dye	Dye %	Method	mμ	Time in Minutes 5	20	35	50	65	80	95	110	125
				Temperature °F 80	110	140	170	200	206	206	170	140
							Per Cent Sorption					
Du Pont Azo Yellow Conc	1.0	neutral	435	18	33	39	40	37	34	33	53	62
		amm acet	435	30	55	76	83	77	77	77	91	95
		acetic	435	38	80	95	94	88	87	87	95	97
Du Pont Metanil Yellow Conc	1.0	neutral	435	0	15	32	19	19	17	14	26	35
		amm acet	435	26	56	74	85	84	83	84	95	97
		acetic	435	34	71	96	100	100	100	100	100	100
Du Pont Milling Yellow 5G Conc	1.0	neutral	435	31	37	47	47	46	46	46	51	55
		amm acet	435	27	47	78	92	96	96	97	100	100
		acetic	435	33	64	97	100	100	100	100	100	100
Du Pont Milling Yellow GN Conc 250%	1.0	neutral	435	16	18	25	38	46	50	49	51	53
		amm acet	435	19	23	32	62	83	92	96	98	99
		acetic	435	28	37	59	91	97	100	100	100	100
Du Pont Milling Yellow R Conc	1.0	neutral	435	25	25	30	42	52	56	57	63	63
		amm acet	435	24	34	53	75	92	98	98	100	100
		acetic	435	37	51	74	99	100	100	100	100	100
Du Pont Neutral Yellow GS	1.0	neutral	435	46	66	83	87	87	90	91	92	94
		amm acet	435	60	90	99	100	100	100	100	100	100
		acetic	435	62	95	100	100	100	100	100	100	100
Du Pont Quinoline Yellow Conc	1.0	neutral	435					No affinity				
		amm acet	435	8	21	33	40	42	43	43	59	70
		acetic	435	16	47	77	97	97	97	97	99	100
Du Pont Tartrazine Conc	1.0	neutral	435					No affinity				
		amm acet	435	5	6	7	10	12	13	13	16	18
		acetic	435	11	23	35	57	77	79	79	81	84
Pontacyl Light Yellow GG Conc 125%	1.0	neutral	435					No affinity				
		amm acet	435	8	15	18	24	33	36	38	46	53
		acetic	435	24	57	77	96	99	100	100	100	100
Pontacyl Light Yellow 3G Conc 150%	1.0	neutral	435					No affinity				
		amm acet	435	7	13	17	22	28	32	33	39	43
		acetic	435	23	49	71	95	100	100	100	100	100
Pontacyl Light Yellow GX	1.0	neutral	435	8	13	13	13	13	13	6	5	5
		amm acet	435	5	10	15	21	26	31	32	37	43
		acetic	435	13	25	44	75	96	99	99	100	100
Du Pont Milling Orange R Conc	1.0	neutral	435	26	26	34	48	60	68	70	76	76
		amm acet	435	26	29	39	69	80	92	100	100	100
		acetic	435	29	38	60	82	96	98	100	100	100
Du Pont Milling Orange RN Conc 125%	1.0	neutral	435	12	22	29	40	47	48	48	50	52
		amm acet	435	16	27	43	71	87	96	99	99	100
		acetic	435	22	36	65	89	97	99	99	99	100
Du Pont Orange II Conc	1.0	neutral	435	7	12	14	15	15	15	8	8	12
		amm acet	435	15	33	48	62	59	56	59	70	79
		acetic	435	24	53	77	97	95	95	95	98	98
Du Pont Orange G	1.0	neutral	435					No affinity				
		amm acet	435	6	12	16	21	23	23	25	28	33
		acetic	435	15	32	51	76	86	85	85	88	90
Du Pont Orange RO	1.0	neutral	435	9	13	17	19	20	20	18	19	23
		amm acet	435	13	33	52	67	72	70	71	84	90
		acetic	435	22	50	84	98	98	98	98	100	100
Du Pont Silk Orange R Ex. Conc 125%	1.0	neutral	435	8	17	23	29	31	31	29	36	38
		amm acet	435	17	31	56	74	80	82	83	90	91
		acetic	435	21	49	82	99	99	99	99	100	100
Du Pont Neutral Brown BGL	1.0	neutral	435	29	29	37	50	63	65	66	70	71
		amm acet	435	29	44	63	84	96	98	100	100	100
		acetic	435	46	64	91	100	100	100	100	100	100
Du Pont Neutral Brown RS	1.0	neutral	435	19	27	45	67	73	79	79	85	86
		amm acet	435	18	22	49	81	96	98	98	99	100
		acetic	435	30	47	69	95	98	98	99	100	100
Du Pont Neutral Brown 2RS	1.0	neutral	435	27	28	45	67	74	80	83	86	89
		amm acet	435	24	24	53	85	97	99	99	100	100
		acetic	435	45	57	76	97	99	100	100	100	100
Du Pont Resorcin Brown 5G Conc 200%	1.0	neutral	435	10	27	42	53	56	58	59	60	65
		amm acet	435	18	42	66	76	87	89	91	95	97
		acetic	435	24	50	78	98	100	100	100	100	100
Du Pont Resorcin Brown 3R	1.0	neutral	435	9	13	22	27	29	31	28	28	30
		amm acet	435	13	22	39	55	70	86	91	95	98
		acetic	435	18	81	92	92	99	99	99	100	100
Pontacyl Fast Brown CGS	1.0	neutral	435	19	26	45	60	66	72	74	81	85
		amm acet	435	22	42	76	93	95	96	97	98	99
		acetic	435	27	59	98	99	99	99	99	99	100
Du Pont Azo Eosine 2B	1.0	neutral	515					No affinity				
		amm acet	515	6	8	9	11	13	14	16	19	22
		acetic	515	11	21	38	62	91	99	99	100	100
Du Pont Azo Eosine G	1.0	neutral	515	9	18	27	29	32	29	27	33	38
		amm acet	515	21	49	73	85	87	87	87	95	98
		acetic	515	37	77	99	100	100	100	100	100	100
Du Pont Anthraquinone Rubine R Conc	1.0	neutral	515	2	4	5	11	13	16	18	18	19
		amm acet	515	10	19	35	62	78	87	91	97	100
		acetic	515	28	61	98	100	100	100	100	100	100
Du Pont Crocein Scarlet N Extra	1.0	neutral	515	6	7	10	12	12	11	9	9	9
		amm acet	515	3	12	24	35	50	59	62	73	78
		acetic	515	10	20	46	75	99	100	100	100	100
Du Pont Milling Red B Conc	1.0	neutral	550	18	23	31	44	56	64	69	74	77
		amm acet	550	21	37	46	71	91	99	100	100	100
		acetic	550	23	54	78	94	100	100	100	100	100
Du Pont Milling Red 3B Conc	1.0	neutral	550	19	23	26	44	62	72	75	80	83
		amm acet	550	15	27	35	67	91	99	100	100	100
		acetic	550	17	36	58	81	97	100	100	100	100
Du Pont Milling Red R Conc	1.0	neutral	515	12	13	20	44	44	61	64	64	69
		amm acet	515	13	17	27	78	96	98	99	100	100
		acetic	515	18	27	58	96	99	100	100	100	100
Du Pont Milling Red SWB Conc 125%	1.0	neutral	515	10	12	18	31	43	48	49	53	55
		amm acet	515	24	25	39	66	83	91	93	95	97
		acetic	515	28	39	62	87	100	100	100	100	100

APPENDIX III—RATE OF ABSORPTION OF ACID DYES ON SPUN NYLON Y/.RN (*Continued*)

Dye	Dye %	Method	mμ	Time in Minutes 5	20	35	50	65	80	95	110	125
				Temperature °F 80	110	140	170	200	206	206	170	140
				Per Cent Sorption								
Du Pont Milling Red SWG Conc 125%	1.0	neutral	515	16	17	24	32	39	44	46	50	54
		amm acet	515	19	33	40	69	87	95	98	99	99
		acetic	515	30	39	57	88	95	100	100	100	100
Pontacyl Carmine 2B	1.0	neutral	515					No affinity				
		amm acet	515	6	13	20	30	38	42	46	49	56
		acetic	515	15	31	53	89	99	99	100	100	100
Pontacyl Carmine 6B Ex. Conc 125%	1.0	neutral	515	16	16	15	18	19	17	14	14	12
		amm acet	515	14	17	21	27	31	35	37	44	48
		acetic	515	17	29	50	76	97	100	100	100	100
Pontacyl Carmine 2G Conc 150%	1.0	neutral	515					No affinity				
		amm acet	515	8	12	18	23	29	34	38	46	50
		acetic	515	17	30	48	73	97	99	99	99	100
Pontacyl Fast Red AS Ex Conc	1.0	neutral	515	8	12	14	19	26	29	29	35	38
		amm acet	515	40	47	65	88	94	93	93	98	99
		acetic	515	23	49	80	89	93	100	100	100	100
Pontacyl Light Red 4BL Conc 175%	1.0	neutral	515					No affinity				
		amm acet	515	6	11	19	25	37	45	46	62	66
		acetic	515	12	23	41	65	91	99	98	99	100
Pontacyl Light Red BLX	1.0	neutral	515					No affinity				
		amm acet	515	5	12	18	27	35	46	52	64	72
		acetic	515	11	31	56	93	99	99	99	100	100
Pontacyl Light Scarlet EG	1.0	neutral	515					No affinity				
		amm acet	515	4	7	9	12	16	20	21	25	30
		acetic	515	11	25	38	64	89	95	95	97	98
Pontacyl Rubine R Ex Conc 125%	1.0	neutral	515					No affinity				
		amm acet	515	11	14	25	36	49	72	73	77	80
		acetic	515	15	33	60	86	98	99	99	100	100
Pontacyl Ruby PL Ex Conc 200%	1.0	neutral	515	12	26	40	44	46	51	51	66	72
		amm acet	515	19	43	70	84	90	95	96	98	99
		acetic	515	30	65	95	99	99	100	100	100	100
Pontacyl Scarlet R Conc	1.0	neutral	515	7	7	8	9	12	12	13	12	13
		amm acet	515	8	13	21	37	65	86	95	98	99
		acetic	515	14	22	48	74	91	99	100	100	100
Du Pont Anthraquinone Violet R	1.0	neutral	550	8	13	18	20	23	23	19	18	16
		amm acet	550	19	23	37	51	68	81	88	92	95
		acetic	550	22	31	52	85	100	100	100	100	100
Du Pont Anthraquinone Violet 3R	1.0	neutral	550	12	13	14	17	19	25	17	17	17
		amm acet	550	13	20	35	54	75	88	92	99	100
		acetic	550	20	34	61	100	100	100	100	100	100
Pontacyl Fast Violet 10B Conc 175%	1.0	neutral	575					No affinity				
		amm acet	575	4	5	7	10	10	11	12	13	13
		acetic	575	8	11	27	41	54	62	67	74	79
Pontacyl Fast Violet VR	1.0	neutral	515	6	7	9	11	13	14	14	13	13
		amm acet	515	6	11	23	35	46	56	62	71	75
		acetic	515	25	40	62	84	97	98	99	99	100
Pontacyl Violet 4BL Conc 125%	1.0	neutral	575					No affinity				
		amm acet	575	5	6	10	18	22	22	29	37	45
		acetic	575	13	16	32	67	80	90	93	96	97
Pontacyl Violet 4BSN Conc 125%	1.0	neutral	550					No affinity				
		amm acet	550	1	10	13	19	23	28	32	35	43
		acetic	550	11	29	51	89	98	98	98	99	99
Pontacyl Violet C4BN	1.0	neutral	550	9	9	9	14	16	16	16	16	13
		amm acet	550	30	31	36	43	54	56	67	75	78
		acetic	550	41	45	63	94	99	99	99	100	100
Pontacyl Violet RL	1.0	neutral	525					No affinity				
		amm acet	525	4	9	16	26	39	47	53	65	70
		acetic	525	10	26	52	91	100	100	100	100	100
Pontacyl Violet 6R Conc 150%	1.0	neutral	550	12	13	14	19	17	17	14	12	10
		amm acet	550	15	22	34	49	62	71	72	81	87
		acetic	550	13	39	72	98	99	100	100	100	100
Pontacyl Violet S4B	1.0	neutral	550					No affinity				
		amm acet	550	7	8	13	22	33	42	49	61	66
		acetic	550	16	23	42	74	94	97	98	99	100
Du Pont Anthraquinone Blue AB	1.0	neutral	645	9	17	25	29	31	32	29	36	42
		amm acet	645	26	48	71	87	90	93	96	97	99
		acetic	645	52	87	100	100	100	100	100	100	100
Du Pont Anthraquinone Blue B	1.0	neutral	575					No affinity				
		amm acet	575	5	6	8	10	16	18	20	28	33
		acetic	575	11	29	56	98	98	99	100	100	100
Du Pont Anthraquinone Blue BGA	1.0	neutral	645	10	13	16	17	17	21	20	19	23
		amm acet	645	6	15	23	27	32	32	33	34	36
		acetic	645	13	21	36	63	77	83	86	91	94
Du Pont Anthraquinone Blue BN	1.0	neutral	575					No affinity				
		amm acet	575	10	13	16	21	25	26	27	34	40
		acetic	575	16	35	70	98	100	100	100	100	100
Du Pont Anthraquinone Blue 2GA	1.0	neutral	645	16	32	37	39	40	38	38	54	62
		amm acet	645	33	76	92	95	95	95	95	98	98
		acetic	645	49	97	99	100	100	100	100	100	100
Du Pont Anthraquinone Blue 3G	1.0	neutral	645					No affinity				
		amm acet	645	9	21	31	43	56	66	68	83	87
		acetic	645	18	43	78	98	100	100	100	100	100
Du Pont Anthraquinone Blue 4GL	1.0	neutral	645	17	28	37	37	37	33	30	27	30
		amm acet	645	20	45	65	79	82	84	84	95	100
		acetic	645	35	73	98	100	100	100	100	100	100
Du Pont Anthraquinone Blue RA	1.0	neutral	645	18	35	42	44	44	44	43	57	66
		amm acet	645	33	79	93	95	95	95	95	97	100
		acetic	645	48	97	100	100	100	100	100	100	100
Du Pont Anthraquinone Blue RXO	1.0	neutral	645	10	14	21	26	28	31	31	35	40
		amm acet	645	16	28	45	64	77	82	84	89	94
		acetic	645	37	52	79	99	99	100	100	100	100
Du Pont Anthraquinone Blue SEN	1.0	neutral	645					No affinity				
		amm acet	645	10	15	17	20	24	28	28	32	39
		acetic	645	18	36	60	93	99	99	100	100	100
Du Pont Anthraquinone Blue SKY	1.0	neutral	575	8	13	17	24	30	34	34	40	45
		amm acet	575	19	42	68	86	92	95	95	98	99
		acetic	575	26	66	97	98	100	100	100	100	100
Du Pont Anthraquinone Blue SWB	1.0	neutral	575	8	13	17	19	19	19	19	24	28
		amm acet	575	16	35	44	50	51	54	56	62	64
		acetic	575	39	68	94	100	100	100	100	100	100
Du Pont Anthraquinone Blue SWF Conc 150%	1.0	neutral	575	13	26	31	35	38	39	40	45	55
		amm acet	575	33	76	91	95	96	96	98	99	100
		acetic	575	53	87	99	99	100	100	100	100	100

APPENDIX III—RATE OF ABSORPTION OF ACID DYES ON SPUN NYLON YARN (*Concluded*)

Dye	Dye %	Method	mμ	Time in Minutes 5	20	35	50	65	80	95	110	125
				Temperature °F 80	110	140	170	200	206	206	170	140
				Per Cent Sorption								
Du Pont Anthraquinone Blue WSA	1.0	neutral	575					No affinity				
		amm acet	575	6	7	9	11	15	18	20	24	30
		acetic	575	18	35	63	94	99	100	100	100	100
Du Pont Anthraquinone Iris R	1.0	neutral	550	5	6	8	11	11	10	11	11	15
		amm acet	550	11	30	52	72	80	83	87	95	97
		acetic	550	22	52	91	99	99	100	100	100	100
Du Pont Brilliant Milling Blue B Conc 200%	1.0	neutral	550	6	6	6	10	13	12	12	10	10
		amm acet	550	8	10	12	27	42	52	59	74	79
		acetic	550	27	32	49	87	97	99	99	100	100
Du Pont Indigotine Conc	1.0	neutral	645					No affinity				
		amm acet	645	7	8	12	15	18	23	24	31	36
		acetic	645	9	27	61	87	97	97	97	99	100
Pontacyl Brilliant Blue A	1.0	neutral	645					No affinity				
		amm acet	645	5	9	12	19	25	31	37	45	49
		acetic	645	13	20	45	70	86	93	95	98	99
Pontacyl Brilliant Blue E	1.0	neutral	645					No affinity				
		amm acet	645					No affinity				
		acetic	645	5	10	18	33	63	82	89	93	96
Pontacyl Brilliant Blue RR Conc 200%	1.0	neutral	575	7	8	9	15	19	18	16	17	19
		amm acet	575	9	9	17	32	45	57	65	78	82
		acetic	575	21	21	43	82	93	96	97	99	100
Pontacyl Brilliant Blue V	1.0	neutral	645					No affinity				
		amm acet	645					No affinity				
		acetic	645	8	11	23	47	62	72	77	83	86
Pontacyl Fast Blue GB Ex Conc 125%	1.0	neutral	550	13	13	22	41	41	59	73	83	87
		amm acet	550	11	16	53	89	98	99	100	100	100
		acetic	550	17	34	72	96	98	100	100	100	100
Pontacyl Fast Blue R	1.0	neutral	550	6	8	10	14	20	22	22	22	21
		amm acet	550	6	10	20	31	49	64	74	79	84
		acetic	550	12	20	26	52	96	99	100	100	100
Pontacyl Fast Blue 5R Conc	1.0	neutral	550	9	12	18	30	39	49	54	62	65
		amm acet	550	13	18	44	84	96	99	100	100	100
		acetic	550	16	24	49	87	98	99	100	100	100
Pontacyl Fast Blue SB Conc 150%	1.0	neutral	575					No affinity				
		amm acet	575	8	12	22	33	49	65	73	79	82
		acetic	575	10	17	35	67	98	100	100	100	100
Pontacyl Navy Blue M4B Conc 200%	1.0	neutral	550	11	12	17	33	44	56	59	60	66
		amm acet	550	19	24	30	66	91	97	98	100	100
		acetic	550	18	24	31	75	98	100	100	100	100
Pontacyl Wool Blue BL Conc 200%	1.0	neutral	575	10	15	27	38	46	54	56	66	72
		amm acet	575	14	23	46	71	87	94	96	99	99
		acetic	575	20	31	61	95	99	99	100	100	100
Pontacyl Wool Blue GL Conc 250%	1.0	neutral	575	13	18	28	40	44	48	53	62	69
		amm acet	575	18	22	43	67	84	92	95	99	99
		acetic	575	32	40	67	93	99	100	100	100	100
Du Pont Anthraquinone Green G	1.0	neutral	645	21	25	30	31	33	35	35	35	37
		amm acet	645	15	22	32	45	59	73	79	87	89
		acetic	645	19	30	49	79	96	99	99	100	100
Du Pont Anthraquinone Green GN	1.0	neutral	645	12	24	32	35	38	39	39	39	41
		amm acet	645	21	29	40	55	68	78	82	90	92
		acetic	645	26	36	48	78	97	98	99	100	100
Du Pont Brilliant Milling Green B Conc	1.0	neutral	645	5	10	12	13	16	18	20	23	23
		amm acet	645	9	9	13	19	25	32	37	47	51
		acetic	645	13	17	36	61	82	92	94	98	99
Du Pont Naphthol Green B Ex Conc 125%	1.0	neutral	645					No affinity				
		amm acet	645	6	7	7	7	15	20	22	22	22
		acetic	645	5	12	20	45	74	83	89	92	92
Pontacyl Dark Green B Conc 175%	1.0	neutral	575	12	14	14	19	19	21	21	21	21
		amm acet	575	14	19	27	42	58	70	76	83	86
		acetic	575	14	26	39	69	70	99	100	100	100
Pontacyl Dark Green G Conc 175%	1.0	neutral	575	8	8	9	10	14	17	15	13	15
		amm acet	575	8	19	25	36	53	68	74	85	91
		acetic	575	16	32	50	87	100	100	100	100	100
Pontacyl Green BL Ex Conc 200%	1.0	neutral	645	2	7	10	12	24	25	27	35	37
		amm acet	645	0	2	7	14	22	33	36	42	47
		acetic	645	6	8	23	48	82	93	95	98	99
Pontacyl Green NV Ex Conc	1.0	neutral	645					No affinity				
	1.0	neutral	645	2	4	5	10	13	16	16	20	26
		acetic	645	13	22	44	68	78	83	86	91	95
Pontacyl Green SN Ex	1.0	neutral	645					No affinity				
		amm acet	645	4	6	8	10	11	11	12	15	15
		acetic	645	6	11	34	49	64	75	79	87	91
Du Pont Neutral Gray L	1.0	neutral	645	32	51	55	65	67	72	75	75	78
		amm acet	645	31	54	76	97	100	100	100	100	100
		acetic	645	58	84	100	100	100	100	100	100	100
Du Pont Naphthylamine Black V Conc 125%	4.0	neutral	515	8	11	18	21	27	32	34	35	38
		amm acet	515	6	10	21	35	51	65	69	74	74
		acetic	515	10	12	18	31	58	76	79	81	81
Pontacyl Black GRF Conc 125%	4.0	neutral	575	14	15	16	17	19	20	23	21	22
		amm acet	575	6	6	14	21	32	44	46	51	52
		acetic	575	10	11	21	32	52	65	67	67	68
Pontacyl Blue Black RC	4.0	neutral	575					No affinity				
		amm acet	575	6	6	10	14	15	18	18	18	18
		acetic	575	2	7	13	18	27	35	35	35	35
Pontacyl Blue Black SX	4.0	neutral	575	10	11	16	16	19	22	19	19	17
		amm acet	575	9	12	19	23	31	41	42	45	49
		acetic	575	9	13	20	30	47	47	55	55	54
Pontacyl Blue Black SXR	4.0	neutral	575	9	9	15	17	20	21	21	20	17
		amm acet	575	9	10	15	21	29	38	40	42	40
		acetic	575	9	14	18	27	42	49	48	46	45
Pontacyl Fast Black BBN	4.0	neutral	550	11	11	11	20	38	48	57	59	62
		amm acet	550	13	13	18	40	65	79	82	85	85
		acetic	550	11	14	20	44	73	84	87	89	89
Pontacyl Fast Black BBO	4.0	neutral	550	9	23	29	42	52	61	65	66	68
		amm acet	550	7	23	26	47	70	78	83	84	84
		acetic	550	11	30	39	57	77	83	85	85	86
Pontacyl Fast Black N2B Conc 200%	4.0	neutral	550	19	19	23	26	26	27	27	30	31
		amm acet	550	16	21	24	32	43	59	66	71	74
		acetic	550	19	19	26	42	55	69	72	76	78

APPENDIX IV

DESORPTION OF ACID DYES ON WOOL YARN

	Desorption Index
Du Pont Azo Yellow Conc	158
Du Pont Quinoline Yellow Conc	94
Du Pont Metanil Yellow Conc	61
Pontacyl Light Yellow GX	47
Pontacyl Light Yellow GG Conc 125%	26
Pontacyl Light Yellow 3G Conc 150%	25
Du Pont Tartrazine Conc	10
Du Pont Milling Yellow 5G Conc	8
Du Pont Neutral Yellow GS	4
Du Pont Milling Yellow GN Conc 250%	3
Du Pont Milling Yellow R Conc	1
Du Pont Orange II Conc	61
Du Pont Orange G	49
Du Pont Orange RO	30
Du Pont Silk Orange R Extra Conc 125%	16
Du Pont Milling Orange RN Conc 125%	4
Du Pont Milling Orange R Conc	2
Du Pont Resorcin Brown 5G Conc 200%	14
Du Pont Resorcin Brown 3R	5
Du Pont Neutral Brown RS	3
Du Pont Neutral Brown 2RS	2
Pontacyl Fast Brown CGS	1
Du Pont Azo Eosine G	49
Pontacyl Light Scarlet EG	48
Pontacyl Carmine 6B Extra Conc 125%	33
Pontacyl Carmine 2G Conc 150%	30
Pontacyl Ruby PL Extra Conc 200%	27
Pontacyl Light Red BLX	24
Du Pont Anthraquinone Rubine R Conc	21
Pontacyl Carmine 2B	18
Pontacyl Light Red 4BL Conc 175%	18
Pontacyl Fast Red AS Extra Conc	8
Du Pont Azo Eosine 2B	7
Pontacyl Rubino R Extra Conc 125%	7
Du Pont Crocein Scarlet N Extra	5
Du Pont Milling Red B Conc	2
Du Pont Milling Red 3B Conc	1
Du Pont Milling Red R Conc	1
Du Pont Milling Red SWB Conc 125%	1
Du Pont Milling Red SWG Conc 125%	1
Pontacyl Scarlet R Conc	1
Pontacyl Fast Violet 10B Conc 175%	83
Pontacyl Fast Violet VR	19
Pontacyl Violet 4BSN Conc 125%	18
Pontacyl Violet 4BL Conc 125%	17
Pontacyl Violet RL	13
Pontacyl Violet S4B	8
Pontacyl Violet 6R Conc 150%	5
Pontacyl Violet C4BN	4
Du Pont Anthraquinone Violet R	3
Du Pont Anthraquinone Violet 3R	2
Du Pont Anthraquinone Blue BGA	82
Pontacyl Brilliant Blue V	80
Du Pont Anthraquinone Blue RA	32
Du Pont Anthraquinone Blue SEN	31
Du Pont Indigotine Conc	31
Du Pont Anthraquinone Blue 2GA	28
Pontacyl Brilliant Blue A	26
Du Pont Anthraquinone Blue RXO	25
Du Pont Anthraquinone Blue SWB	25
Du Pont Anthraquinone Iris R	23
Du Pont Anthraquinone Blue BN	22
Du Pont Anthraquinone Blue WSA	22
Pontacyl Brilliant Blue E	22
Du Pont Anthraquinone Blue AB	21
Du Pont Anthraquinone Blue 4GL	21
Du Pont Anthraquinone Blue B	20
Du Pont Anthraquinone Blue SWF Conc 150%	18
Pontacyl Fast Blue 5R Conc	17
Du Pont Anthraquinone Blue SKY	13
Pontacyl Brilliant Blue RR Conc 200%	9
Du Pont Brilliant Milling Blue B Conc 200%	8
Pontacyl Fast Blue GB Extra Conc 125%	8
Du Pont Anthraquinone Blue 3G	7
Pontacyl Wool Blue BL Conc 200%	4
Pontacyl Wool Blue GL Conc 250%	4
Pontacyl Fast Blue R	1
Pontacyl Fast Blue SB Conc 150%	1
Pontacyl Navy Blue M4B Conc 200%	1
Pontacyl Green SN Extra	107
Pontacyl Green NV Extra	79
Pontacyl Green BL Extra Conc 200%	32
Du Pont Brilliant Milling Green B Conc	22
Du Pont Anthraquinone Green GN	7
Du Pont Anthraquinone Green G	6
Pontacyl Dark Green B Conc 175%	3
Pontacyl Dark Green G Conc 175%	2
Du Pont Naphthol Green B Extra Conc 125%	0
Du Pont Neutral Gray L	4
Du Pont Naphthylamine Black V Conc 125%	2
Pontacyl Blue Black SX	2
Pontacyl Fast Black BBO	2
Pontacyl Black GRF Conc 125%	1
Pontacyl Blue Black RC	1
Pontacyl Blue Black SXR	1
Pontacyl Fast Black N2B Conc 200%	1
Pontacyl Fast Black BBN	0

APPENDIX V

DESORPTION OF METALIZED DYES ON WOOL YARN

	Desorption Index	
	With 6% Sulfuric Acid	With 12% Sulfuric Acid
Chromacyl Yellow GR	128	165
Chromacyl Yellow N	164	178
Chromacyl Orange GE	135	156
Chromacyl Orange 2G	46	68
Chromacyl Orange GR	137	204
Chromacyl Orange R	55	75
Chromacyl Brilliant Pink 3B	109	137
Chromacyl Pink BN	55	77
Chromacyl Bordeaux R	114	137
Chromacyl Blue GG Conc 200%	60	70
Chromacyl Blue R	71	100
Chromacyl Black W	9	11

H F Clapham, delivering Philadelphia Section Contest Paper

Frederick T Simon, delivering South Central Section Contest Paper

Intersectional Contest—

SPECTROPHOTOMETRIC STUDIES OF CONTINUOUS DYEING*

SOUTH-CENTRAL SECTION

The object of this study is to present a simple, yet fairly precise procedure of measurement of dye mixtures and to show data obtained from actual mill runs.

The elimination of all highly technical functions from the spectrophotometric part of this work was kept in mind so that a method adaptable for "in the plant" control is demonstrated. Several types of continuous dyeing are discussed.

Committee

FREDERICK T. SIMON, *Chairman and Speaker*

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INTRODUCTION

MOST writers and prognosticators for the textile industry are fairly well agreed that the trend in dyeing is toward a greater proportion of continuous dyeing. This trend is about equally the product of a desire to produce greater uniformity of shade because of customer demands and of a desire for economy, which dictates a reduction of unit labor costs. The penalty of continuous dyeing is that greater pains must be taken to arrive at the correct shade before any sizeable quantity of cloth is run; any off-shade goods must be reprocessed or sold as seconds. This has led to a considerably greater amount of experimental work in conjunction with continuous dyeing than is warranted for batch dyeing. The information accrued from this experimentation has resulted in procedures, control devices, and test methods that have tied down a number of the variables of dyeing by all methods. The most striking thing, however, is that, despite all of the fine techniques developed for most factors, there is virtually a complete disregard in most mills for the precise determination of the most critical factor: the concentration of the dye itself. A spectrophotometer can very profitably be applied to this problem. This device measures the concentration of dyes in solution or on the fiber by physical means. In view of the fact that there are so few of these instruments in use throughout the industry, it is our objective to present this idea in such a manner as to cover a usual mill situation from diverse points of view. The dyer, in general, is primarily concerned with the results, while the chemist is more likely charged with the performance of the test. In the discussion below, several examples of actual mill runs are given where the case is stated from the dyer's point of view, and the details of the method are briefly discussed. Although a General Electric Recording Spectrophotometer was used throughout this work, the methods are designed for control purposes in terms of much simpler instruments.

EXPERIMENTAL

CASE 1: ONE VAT DYESTUFF——— Since the spectrophotometer is a tool that precisely measures the concentration of dyes, it can be employed for a direct investigation of continuous dyeing. Trial dyeings that are used to estimate the amount of dye in booster tanks or Williams Units are notoriously variable; colorimetric determination of dye with a spectrophotometer, however, can be done quickly, simply, and with an accuracy that may easily exceed that of the dyeings. The results are immediately evaluated in terms of the per cent of dye present. One of the simplest examples of this is given in Table I. Here samples were taken during a run of cloth that was dyed with a combination containing predominantly one dyestuff. There is no attempt to cover this whole production of some thirty hours duration, but this example shows ten samples taken about 30 minutes apart, well after the initial shade adjustments had been made. Examination of the data shows that the variations of the vat gray on the cloth bear a close relation to the concentration of the dye in the first unit, but no relation to that in the second. The table also shows a limitation of the method by giving figures only on the vat gray. In general, it can be stated that the practical minimum amount of one component that

TABLE I

VAT GRAY ON BLEACHED, MERCERIZED TWILL

Vat Gray—9.6 oz./gal.
Vat Violet—0.09 oz./gal.
Vat Navy Blue—0.09 oz./gal.

Dyeing process: pigment padding, drying, development in 2 Williams units in tandem containing caustic soda and hydrosulfite

Sample	Conc. Vat Gray in cloth %	Conc. Vat Gray 1st Unit %	Conc. Vat Gray 2nd Unit %
1	100	100	100
2	92	105	100
3	108	110	129
4	93	100	114
5	99	96	114
6	90.5	89	105
7	92	93	105
8	93.5	93	120
9	90.5	85	118
10	96	96	112

* Presented before Twenty-ninth Annual Convention in Portsmouth, N. H., on Sept. 29, 1950.

can be determined on vat dye combinations with any precision is about 3% of the total dye formula. This section of the run represents about six separate mixes or prepared tanks of dye liquor. It then stands to reason that, if each tank of dye liquor were made up in advance, checked, and adjusted (if necessary) before it were used, some of the variability should be reduced. This does not explain the exceptions, as in samples 2, 4, and 9 which may be assignable to differences in goods preparation.

The general method for obtaining the data for Case I is the same as those employed when comparing the strengths of dye shipments by spectrophotometric means *(2, 4)*. It is necessary to have a sufficiently reliable spectrophotometer *(2, 4)*, which is set to measure the solution of the dye in question. In this case an aliquot of the vat-dye suspension is brought into solution by controlled techniques *(3)*, and the measurement and computation of relative concentration are carried out according to the methods given in the literature cited. By this method any one sample is established as 100% and the others are compared with it. The method of dyeing suggests solution techniques of spectrophotometry, rather than reflection, since it is desired to maintain a constant amount of dye in each active part of the machine.

CASE II: TWO VAT DYESTUFFS ———Case II is a run of vat-dyed cotton twill of a different shade than previously given. This case further illustrates what can be done to cope with the limitation of 3% for any one dye component. Here the Vat Black dyestuff is added to the Olive and the two are determined as one dye; the value of the Black itself can be considered to maintain a constant ratio (1 to 30) to the Olive, while the total amount varies.

The run given in Table II shows the same order of relation, cloth to pad and 1st unit, for the Olive (and Black), as in Case I. The amount of Brown in the cloth is not grossly affected by somewhat larger changes in the concentration of this dye in the pad or units. Examination of the last columns of this table might contain the answer, in that the large amounts of Brown—probably a dye of less substantivity than the others—in the units will tend to buffer any rapid changes. The small number of samples do not completely explain the phenomenon, but serve to show what is effectively two-component dyestuff analysis. The last row under each of the unit columns is useful in determining what the equilibrium amount of dye should be in each unit.

The method of Case I is extended for Case II with a computation that must be done one time for each combination of dyestuffs. Where more than one dye is involved, observations of strength must recognize the mutual interference of one dye with another in visible spectra, and calculated correction factors must be applied. However, this is not so difficult as it may sound; in fact, the computation is very much simplified since the data on all samples are to be obtained on a comparative basis where one sample is called 100%. For computing factors we must prepare a suitable solution of each dye, measure it, and record the transmission data in some form like that suggested below. The wave lengths appropriate to the dyes involved are usually the lowest point of the curve (maximum absorption) with due consideration for lack of mutual interferences (see *2*, p. 369).

In order to obtain the correct strength of each dye, the approximate strength is computed at each wave length without regard to the interferences, and these figures later are corrected by multiplication by the factors indicated in equation 3 (Table IIA). This method is extremely valuable for continuous dyeing data where the solution of one simultaneous equation per sample is too laborious to be practical. The short cuts used here merely involve division of the presolved equations usually obtained *(2*, pp. 374 and 377) by several constants, which can be made equal to unity for relative data. Padder sample No. 3 is shown here as an example of how the calculation of the corrections is performed:

TABLE II

VAT FOREST GREEN ON BLEACHED, MERCERIZED TWILL

Vat Olive—9.6 oz./gal
Vat Black—0.3 oz./gal.
Vat Brown—1.7 oz./gal.

Dyeing process: pigment padding, drying, development in 2 Williams units in tandem containing caustic soda and hydrosulfite

Sample	Dye Concentration in Cloth		Dye Concentration in Pad		Dye Concentration in 1st Unit		Dye Concentration in 2nd Unit	
	Brown	Black	Brown	Black	Brown	Black	Brown	Black
1	100	100	100	100	100	100	100	100
2	95	96.5	107	100.5	103	87	128	92
3	95.5	97	117	97.5	107	94	95	111.5
*4	99.5	98.5	113	100	117	104	146.5	107.5
5	102	104.5	99	105.5	121	101.5	135	115.5
*6	100.5	101	111	104.5	121	101.5	139.5	113.5
Unit Sample No. 1 compared with Padder No. 1..					24.7	1.4	22.5	0.6

* A tank with a 5% increase in overall strength was cut in before these samples were taken.

TABLE IIA

COMPUTATION SCHEME FOR CORRECTION FACTORS OF CASE II

	Transmittancy at Wave Length Indicated (All dyes at equal concentration)		
	460*	630*	Sum
Brown	0.248	0.622	
Black	0.445	0.262	
Olive	0.293	0.233	
	Density (= log 1/t)		
Brown	0.606	0.179	
Black	0.352	0.582	
Olive	0.533	0.633	
	Equation 1		
Brown	0.606	—0.179	
Olive & 1/30 Black	—0.545	0.652	
	Equation 2		
Brown	0.652	—0.545	0.107
Olive & 1/30 Black	—0.179	0.606	0.427
	Equation 3		
Brown	6.095	—5.095	1.000
Olive & 1/30 Black	—0.419	1.419	1.000

Equation 1 is obtained from density figures by adding 1/30 of the density given for the Black to that for Olive. The signs of alternate figures are made negative.

Equation 2 is obtained by interchanging each figure in equation 1 by its diagonally opposite element in equation 1. Each row thus obtained is summed with due respect for signs.

Equation 3 is obtained by dividing the "sum" of each row back into the elements of 2 and the results appropriately placed.

* $M\mu$.

Approximate Concentration 460 millimicrons —— 102
630 millimicrons —— 99
Brown——— (102 x 6.095) — (99 x 5.095) = 117
Olive & 1/30 Black——— —(102 x 0.419) + (99 x 1.419) = 97.5

It may be noted here that the concentration of the dyes used to compute the equations need not be the same in the general case of two dyes. The concentration is only important to the addition of the Black to the Olive. Usually the dyestuff strength of the solution need not even be known since only the relative interference at different wave lengths is important to this method.

CASE III: THREE DIRECT DYESTUFFS———Here an entirely different type of dyeing is considered as an instance of a three-component mixture where each component is determined separately. A certain amount of emphasis is placed on this case, not because of the method of dyeing, but that it is the commonest number of dyes used to match most shades in practical mill dyeing. The data given here could be taken from any type of dyeing; the primary difference is in the mathematical method used to facilitate the calculation of the correct dye concentration.

Although there are just a few samples taken on this short run, certain information is indicated. First, there seems to be an equilibrium established in the padder at somewhere around 140% of the start. Second, the continued increase in concentration of dye in the units would lead one to believe that the amount of salt in the units is too low, since there is bleed-off into them. The data then tell the dyer that he should make up a starting bath different from the feed and increase the amount of salt used in the units until a reasonably stable condition is reached. After such changes are made that would be justified on the basis of the results determined and the experience of the dyer, new information must be gathered until satisfactorily constant concentrations of dye are obtained. The knowledge gained in one run can guide the next production of that particular shade unless all of the spectrophotometric work is done right along with the run and the instrument located in the same vicinity as the dyeing machinery. In order to be certain that all tanks are made up exactly correct, they are compared with an acceptable, known standard before the run is started. This is cheap insurance against any errors or changes in constituent concentrations.

The principles outlined heretofore are applied in combinations containing three dyes; it is only the mathematics used that varies somewhat from the previous. Correction factors are obtained as in the two dye forms by an abridgment of the classical methods of solution of such a problems. *(5)* It is a special case of a general method which is given here in some detail since it is so important to the average dye formula. Mechanical aids are also suggested to facilitate computation.

The first difference that is evident in this set of figures compared with those in Case II is the use of "apparent concentration", rather than computed density. This may be an advantage particularly to certain instruments that read either in log density or in transmittancy rather than in density. As before, the correction factors are solved first and only one time for each particular combination of dyes. The factors are applied to the three approximate strength comparisons made at the wave lengths used in the factor computation—to the sample set up as 100%.

TABLE III
DIRECT CROSS-DYE GRAY
(FILLING STOCK-DYED; GREY COTTON WARP)

Padder—Direct Orange—0.7 oz./gal.
Direct Red Violet—0.3 oz./gal.
Direct Blue—2.7 oz./gal.

Dyeing process: Pad with solution of three direct dyes; run through Williams Unit in tandem containing salt and same dyes

	Padder			*1st Unit*			*2nd Unit*		
Sample	*Orange*	*Red Violet*	*Blue*	*Orange*	*Red Violet*	*Blue*	*Orange*	*Red Violet*	*Blue*
1—Start	100	100	100	100	100	100	100	100	100
2	139	137	135	179	188	193	141	147	152
3	146	143	143	270	282	289	224	249	274
4—End	149	147	145	391	370	373	359	399	439
Unit sample No. 1 compared with padder No. 1				12.6	10.6	12.0	4.6	3.7	3.6

TABLE IIIA
COMPUTATION SCHEME FOR CORRECTION FACTORS OF CASE III

Apparent Concentration
Equation (1)

Dyestuff	*420*	*520*	*600* *Millimicrons*
Orange	1.000	—0.230	0.069
Red Violet	—0.254	1.000	—0.219
Blue	0.217	—0.455	1.000

	Equation (2)			*Sum*	**Equation (3)**			*Sum*
					420	*520*	*600*	
Orange	0.900	—0.207	—0.101	0.592	1.520	—0.349	—0.171	1.000
Red Violet	0.082	0.869	—0.405	0.546	0.150	1.593	—0.743	1.000
Blue	—0.064	—0.201	0.942	0.677	—0.094	—0.298	1.392	1.000

Equation (1), apparent concentration, is obtained from the spectral data on each dye without regard to the absolute concentration. The transmittancy of each dye at its maximum absorption is termed 1.000 and other transmittancies at several wave lengths are compared to this (proportionally in terms of density).

Equation (2) is set up in a standardized form and is computed from Equation (1). Each of the nine terms of (2) are obtained by multiplication of diagonally placed terms in (1). Signs of the terms of Equation (1) are made alternately negative. There is shown above an aid to this computation, which can be made by cutting out a piece of paper which is placed over equation (1) to solve for each term of (2). A sign rule must also be observed in multiplication: going from left to right; terms that are on the "downward diagonal," the sign is positive, when "upward," negative. For example, the term shown in the cut out as it is placed above—

(1.000 x 1.000) — (—0.455 x —0.219) = 1.000 — 0.100 = 0.900

Equation (3) is obtained from (2) by dividing the sum of each row back into the elements of (2) and the results appropriately placed.

CONCLUSION

We have discussed here a practical method, which can be directly applied to mill problems by people who are competent enough to run many of the other tests that are called for in everyday technical operations in a modern textile mill. There is enough information available today that it should be possible for many people to run a spectrophotometer and to obtain data like that given above without any specialized training in spectrophotometry. We do not wish to infer in this paper that this is the first application of spectrophotometry to continuous dyeing; it has had a long and successful history in certain mills. The unique things presented here are the following: 1. an application to vat dyeing, 2. an application involving Williams Units, and 3. a simplified mathematical method for several components.

These trials and data are the result of the kind co-operation of the manage-

ment and various persons of the Crystal Springs Bleachery, Chickamauga, Georgia; Riegel Textile Corporation, Trion, Georgia; and Peerless Woolen Mills, Rossville, Georgia, with the members of the contest-paper committee.

REFERENCES

(1) "Spectrophotometry", Gibson, K. S., National Bureau of Standards, Circular 484.

(2) "Analytical Absorption Spectroscopy", Mellon, M. G., Editor, John Wiley & Sons, New York, 1950.

(3) Simon, F. T., *Textile Research J.* 19, 567, (1949).

(4) Stearns, E. I., *Am. Dyestuff Reptr.* 39, P358 (1950).

(5) Davidson, H R and Godlove, I H, *Am. Dyestuff Reptr.* 39, 628 (1950).

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Report of Western New England Section Meeting

A MEETING of the Western New England Section was held on December 15, 1950 at Rapp's Restaurant, Shelton, Connecticut. The speaker was Professor E. R. Schwarz who gave a talk on "Recent Developments in Textile Research."

Professor Schwarz discussed the value of simple statistics and the importance of correctly interpreting them. He also emphasized the importance of fabric geometry. It is pointed out that this aspect of fabric construction, although of fundamental importance, has not been adequately investigated in the past. A better understanding of it should be essential in properly correlating a fabric's use performance with its structure.

Respectfully submitted,

A S NYQUIST, *Secretary*

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Report of New York Section Meeting

A MEETING of the New York Section was held on Friday evening, January 12th, at the Hotel New Yorker, New York City. A reception and dinner preceded the meeting.

During a brief business session the following were elected councilors: Carl H Brubaker, Standard Bleachery & Printing Co; Ralph M Fischer, American Cyanamid Co; Henry L Young, Textile Colors Division, Interchemical Corp.

Albert E Johnson, Director of Trade Relations for the National Institute of Cleaning and Dyeing, opened the technical meeting with a short address on the cleaning industry, the scope of NICD operations, and the aims of its trade relations activities. George P Fulton, Director of Research of the Institute, then presented a paper entitled "Drycleaning Processes and Problems" which was illustrated by a series of slides in color. There was also a display of dry cleaning equipment furnished through the courtesy of the U S Hoffman Machinery Corporation.

The attendance was approximately 160.

Respectfully submitted,

NORMAN A JOHNSON, *Secretary*

—♦ ♦—

Philadelphia Section Report of December 8 Meeting

A MEETING of the Philadelphia Section was held on December 8th at Kugler's Restaurant in Philadelphia. The Tellers reporting on the election of 1951 Sectional Officers gave the following:

Chairman Emeritus—Elmer C. Bertolet, Temple University

Chairman—A E Raimo, John Campbell & Co

Vice-chairman—Edward C Diehl, Ankokas Dyeing & Processing Co

Secretary—Thomas H Hart, Hart Products Corp

Treasurer—Harry L Morgan, James Lees & Sons

Sectional Committee:—Harry F Clapham, E I duPont de Nemours & Co, Inc; E E Rettberg, Jr, Scholler Bros, Inc; Thomas J Scanlon, Calco Chemical Div; Percival Theel, Phila Textile Institute

Councilors:—James Dixon, Calco Chemical Div; M H Klein, Sandoz Chemical Wks; Richard B Stehle, Allegheny Dye Wks; Frederick V Traut, Globe Dye Wks; Dr S Graeme Turnbull, Jr, E I duPont de Nemours & Co, Inc; Jackson A Woodruff, American Viscose Corp.

The technical portion of the program consisted of a paper presented by Henry E Millson of Calco Chemical Div on the subject "Importance of Fluorescence, Phosphorescence and Radio-activity in the Textile Industry." The talk also included many slides and demonstrations. Approximately 210 members and guests attended this meeting.

Respectfully submitted,

THOMAS H HART, *Secretary*

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Report of Annual Business Meeting, Hudson-Mohawk Section

THE annual business meeting for the calendar year 1950 was held at Jack's Restaurant, Albany, New York on December 8th, 1950. The following were elected to the offices listed for 1951:

Chairman—John J Hanlon, Color Technologist, Mohawk Carpet Mills, Amsterdam, New York

Vice-chairman—Harold S. Dahlberg, Laboratory Director, Kenwood Mills, Rensselaer, New York

Treasurer—Irwin J Smith, President and General Manager, Surpass Chemical Company, Albany, New York

Secretary—William A Nelson, Chief Chemist, Ritter Chemical Company, Incorporated, Amsterdam, New York

Councilor—Albert E Herrman, Jr, Manager of Standardization Laboratory, General Aniline Works, Rensselaer, New York.

Yearly reports of secretary, treasurer, councilor, and cooperate membership committee were presented.

The technical program for the evening was highlighted by a paper entitled "Wool in Mixtures with other Fibers" presented by Dr. Hans Luttringhaus, Head of the Wool Section, Technical Department, General Dyestuff Corporation. An active question and answer period followed the paper. Attendance was 52.

Respectfully submitted,

WILLIAM A NELSON, *Secretary*

Olney Medal Candidates

The Committee of Award would like suggestions regarding candidates for this year's Olney Medal. They should be in the hands of H C Chapin, Secretary of the Association, not later than March 9th. Data on the accomplishments of candidates should be specific in such matters as journal references or patents, but all definite information will be helpful. Letters from several sponsors of one candidate are needless, except for giving additional data.

Under the rules the basis of award is outstanding achievement in the field of textile chemistry, which is understood to include the development of chemical agents or chemical processes used in the manufacture of textiles or methods of evaluation.

In making awards, the Committee need not be confined to the consideration of any one specific achievement or contribution but may in its discretion consider the sum total of various and continued contributions to the field no matter of how long duration.

The citation of the award drawn by the Committee and accompanying the presentation of the medal shall set forth clearly the occasion for the award.

The voting members of the Committee are Wyss L Barker, William D Appel, Harold W Leitch, C Norris Rabold and Henry A Rutherford.

• PATENT DIGEST •

PAUL WENGRAF

WATER REPELLENT FABRICS ——Solutions of Organosilicon Halides at Low Temperatures G, 2, 02

U. S. Pat. 2,519,232
(American Viscose Corp.—Cruz, Jr.—Aug. 15, 1950)

It has been previously suggested that organosilicon halides be used in vapor form to render fabrics water repellent. This method proved to be unsatisfactory (according to the present patent) because of the tendering action of hydrochloric acid, evolved by the reaction of the silicon halide with moisture contained in textile fabrics. It was necessary to operate for a comparatively long period at temperatures high enough to keep the organosilicon compound in gaseous form. This invention is based on the discovery that the two phases of the reaction proceed at different speed. While the moisture reacts with the halide very rapidly to completion and almost at the same speed regardless of the ambiant temperature, the reaction of hydrochloric acid on cellulose and, thus, the extent of the tendering action, is a function of the temperature. The higher the reaction temperature, the greater the loss on tensile strength or the drop of the degree of polymerization of the cellulosic material. This loss on (wet) tensile strength can be as much as 20% (from 1.63 gm. per denier to 1.27 gms.). Consequently, it is proposed that the organosilicon halide treatment be carried out in a solution of an indifferent organic solvent (carbon tetrachloride) at temperatures of 0- 25°C., preferably at 7°C. The water repellency of the cellulosic material was found to be good to excellent in proportion to the amount of the organosilicon halide applied, while at this temperature depolymerization of the fiber and loss on tensile strength were insignificant. The importance of the moisture content of the fiber should be pointed out: the normal water content of regenerated cellulose is between 8-16%, that of natural cellulose between 6-9%. Cellulose acetate generally has a lower moisture content and since the correct percentage of moisture is essential for the perfect reaction, a pretreatment of the fibers to bring them to the optimal water content either by humidifying or by dehydrating in an organic solvent is within the scope of this invention. It should be emphasized further that the siliconhalide treatment alters the dye affinity of the fibers so that interesting two-shaded dye-effects in mixtures of treated and nontreated fibers can be obtained. An example cites the immersion of a rayon fabric in a 1% solution of methylsilicon chloride in CCl_4 at 7°C. for 60 seconds, neutralizing thereupon in dilute ammonia for 20 min. at 10°C. and rinsing at room temperature until the material is neutral.

References cited by the Patent Office, among others:

U. S. Pat. 2,438,689 (Corning Glass Works—1948): treating glass (also glass fiber tape) by impregnating or coating with a higher alkylsilicon chloride and heating thereupon to 110°C., but below the decomposition point of the impregnating agent.

U. S. Pat. 2,436,304 (Corning Glass Works—1948): treating glass fibers by dipping them into an organic solution of a hydrolyzable organosilicane (phenylsilicon trichloride), heating below its decomposition point and dyeing with acid dyes (cf. REPORTER 1948, 568).

U. S. Pat. 2,408,822 (Tanis—1948): protecting electrical discharge devices by coating them with a hydrolyzed organosilicon compound.

Brit. P. 572,740 (Brit. Thomson Houston—1945): treating for water repellency by subjecting the material to organosilicon halides (methylsilicon chloride) in vapor form. This method refers to glass surfaces as well as to all kind of fibers.

Reference is further made to Du Pont's U. S. Pat. 2,485,603 (cf. REPORTER 1950, 98): fibrous material is rendered water repellent by applying an organic solution of an alkylsilicon halide reacted with thiocyanic acid. This process is carried out at temperatures up to 125°C.

FLAMEPROOFING COMPOSITION: Metal Oxides—Guanidine Phosphate—Ammonia G, 2, 03

U. S. Pat. 2,519,348
(American Cyanamid—Burnell, van Loo—Aug. 22, 1950).

This is a copending application issued the same day (according to the serial number identified with U. S. Pat. 2,519,388, digested above), and it refers to a combined process for flameproofing textiles with metal oxides, guanidine phosphates, urea and vinyl chloride copolymers. A further modification of this flameproofing finish is described in the present patent. The difference between these inventions is a concentrated (28%) ammonia solution, which has to be incorporated in this dispersion at not less than 4% of its total weight. Thus, solution "A" (see above digest) is analogous to that indicated in U. S. Pat. 2,519,388. "B" contains, beside phosphate, a nitrogenous substance (urea, etc.) and the necessary amount of ammonia. This composition proved to be very stable at room temperature, even as long as one month up to one year, obviously due to the ammonia content. This addition is said to be a characteristic feature and a considerable improvement over the process protected by U. S. Pat. 2,519,388. It has been observed that no other alkaline reagent replacing ammonia (i.g., KOH or NaOH) had the same effect. An example calls for homogenizing Sb_2O_3 with monoguanidine phosphate, then adding urea to the dispersion while heating to about 180-190°F., cooling and adding the concentrated ammonia. When the temperature drops to 155°F, an aqueous dispersion of Geon Latex X-15 is slowly stirred in and the temperature kept at 150°F. The dispersion finally contained 81% solids in the example cited and was stable in this concentration for more than five months.

References cited by the Patent Office, among others:

U. S. Pat. 2,413,163 (Du Pont—1946): see above.

U. S. Pat. 2,357,725 (Bennett—1945): see above.

FLAMEPROOFING COMPOSITION: Metal Oxides—Guanidine Phosphate—Urea—Vinylchloride Copolymers G, 2, 03

U. S. Pat. 2,519,388
(American Cyanamid—Loukomsky, Kienle, Cooke—Aug. 22, 1950).

In the preamble of this specification the inventors point to the great variety of compositions hitherto proposed for flameproofing textiles. Reference is made to the book of R. W. Little "Flameproofing Textile Fabrics", which mentions many ingredients (quite generally used in the present method) to impart flame resistance to textile goods. Some of them (e.g., urea-phosphate) are known to have a ten-

dering effect on textile fibers; double precipitation methods or application of metallic oxides combined with organic chlorinated compounds have the disadvantage of giving a harsh hand. The single ingredients used in the present method have to be applied in carefully selected proportions to compensate these reactions, thereby giving the desired durable flame resistance without substantially impairing the original touch of the fabric. The components used in this flameproofing finish consist of two groups (A and B), employed either in a one-bath method or in two separate baths.

"A" contains (1) a finely divided metal oxide (Sn, Ti, Bi or Sb, the latter being preferred) and (2) a halogen-containing plastic substance (e.g., vinylchloride copolymers or copolymers of vinylchloride and alkylacrylates) with a chlorine content of 30-70%. Optimal proportions are 1:0.8 up to 1:4 respectively.

"B" comprises (1) a phosphate (e.g., guanidine phosphate, diguanidine pyrophosphate, ammonium metaphosphate or the like) and (2) a water-soluble nitrogenous substance such as urea (preferably), biuret, ammonium cyanate, etc. The best proportions here are 1:2 to 1:6 respectively.

"A" and "B" are used in the ratio of 1:1 up to 1:3 respectively, wherein the weight of the phosphate is calculated from the phosphoric acid content. It is recommended that "A" be prepared by dispersing the finely divided metal oxide in an aqueous solution of a formaldehyde condensate with a naphthalene sulfonate known as "Tamol" and passing the fluid through a colloid mill. This dispersion is blended with an aqueous vinyl chloride copolymer dispersion (exemplified by the commercial product "Geon Latex X-15"). For "B", an aqueous solution of monoguanidine phosphate, urea, or hexamethylene tetramine may be used. In applying solutions A and B, either combined or in separate steps, the procedure is furthered by impregnating the textiles to a pick up not less than 110%, to dry at 60-80°C. and, finally, to cure at 135-200°C. Of course many details of this complex process are omitted here. From a theoretical point of view, however, it is essential to note (cf. col. 22, 68—col. 23, 4 of the patent) that the effect of the metal oxide is one of catalytic action, dehalogenating the thermoplastic substances (e.g., the polyvinyl-chlorides) to promote rapid formation of HCl at temperatures near the point at which thermal decomposition of the cellulose occurs.

References cited by the Patent Office, among others:

U. S. Pat. 2,461,538 (Interchemical Corp.—1949): insolubilized amino-plast powders (urea-formaldehyde) as glow retardants, dispersed in flame-proofing coatings, containing chlorinated hydrocarbons such as "Aroclor" or other flameproofing ingredients.

U. S. Pat. 2,427,997 (White) (cf. AM. DYESTUFF REPTR. 1947, 720): preparing a fabric to be flameproofed with a warm sodium carbonate solution, then drying and giving it a second passage through antimony chloride in an organic solvent ("Varsol", gasoline), drying again and padding with a soda ash solution.

U. S. Pat. 2,413,163 (Du Pont—1946) (cf. AM. DYESTUFF REPTR. 1947, 338): a flameproofing composition containing a formaldehyde-resin condensate of casein plus phenol, urea or melamine, an inorganic flameproofing agent such as Sb_2O_3 and an organic flame retardant such as chlorinated paraffin wax.

U. S. Pat. 2,357,725 (Bennett—1945): a flameproofing composition, containing an aqueous solution of a water soluble fire retarding agent (ammonium phosphate or -sulfate, or "Abopon", a sodium borophosphate complex) in the dispersed phase and chlorinated rubber in the continuous phase; forms a pliable, flame resistant and wash-fast film.

DYEING CELLULOSE ACETATE—Acid Dyestuffs in Alcoholic Solution—Salt Aftertreatment. C, 4, 07

U S Pat 2,519,498

(Celanese Corp—Olpin, Stanley—Aug 22, 1950)

Cellulose acetate can be dyed with an acid dye solution in a lower diluted alcohol to which a swelling agent (thiocyanate) is added. Great losses of dyestuff have been experienced in some cases in subsequent washing. An example of this is the dyestuff C I 735 (Xylene Fast Green B or other dyes on the same type). According to the present invention this loss is substantially reduced by adding an inorganic salt to the rinsing liquor. Following the wash with salt solution, a further washing operation can be carried out well with plain water.

An example describes a dyebath composed of 750 gm methylated spirits, 250 gm water to which 20 gm sodium—or ammonium thiocyanate and 10 gm of the aforementioned dyestuff are added. Optionally, 30 ml acetic acid may also be added. The dyeing temperature can vary within large limits. The fabric is padded and run from the mangle in a cold 20 per cent common salt solution, then washed and dried.

The advantage of this improvement is that drying after padding, necessary in most cases to obtain fast shades, can be omitted.

This specification refers to U S Pat 2,428,835, dyeing of cellulose acetate with dilute alcoholic solution plus thiocyanate (cf *Am Dyestuff Reptr* 37, 397) (1948)). This is the only reference given by the Patent Office.

FLUORESCENT DYEINGS C, 1

Brit. P. 644,201

(J. L. Switzer and R. L. Switzer—Oct. 4, 1950).

This patent describes an improvement in producing textiles with colored fluorescent effects. The inventors state that even brilliantly fluorescent dyes give dull shades only of weak fluorescence. In contrast thereto the same dyeings exhibit strong fluorescence merely by exposure to ultraviolet rays. Coating fabrics with this type of dye is not successful by reason of poor draping qualities.

According to the present invention the problem of obtaining fluorescent dyeings in daylight as well as in "invisible" light has been solved, and fabrics visible at long distance with a great brilliance of color, suitable for signaling and display devices, decorative cloth and so on, can be obtained by a special dyeing method. The fabrics to be treated consist of translucent fibers, especially of cellulose acetate. The amount of dye incorporated in the fiber is restricted to 0.025 gm. for dyes projecting yellow-green light and to 0.015 gm. for dyes projecting red light, calculated on one cm^3 filament. Limits for the dyestuff content per cm^2 are given as 0.000015 to 0.0005 gm. If a greater percentage of dyes (in general, more than 2%) is applied, the effect is impaired. Another essential feature is that the fabrics have to be dyed from dilute solvent solutions (ethanol, isopropanol, cellosolve) because it is necessary to apply the dye in a "solvated" state to preserve the translucence of the fiber. In this respect the process uses the solvent dyeing methods proposed by Celanese Corp. (cf. AM. DYESTUFF REPTR. 1948, 397). Finally addition of an "invisible" dye in a strong aqueous solution increases the brilliance, but neither the examples nor the claims are restricted to this combination. Dyeing with combined daylight and U. V. light fluorescent dyes is disclosed in examples 7, 8 and 9 of the patent. The "invisible" dye is exemplified by a product of the methyl-umbelliferon class, but the patent does not confine itself to a specific type of "brightening" agent. The temperature of the dyeing baths should approach, but not exceed, a state of beginning coalescence (i.e., the swelling action must be interrupted after dyeing by energetically flushing water to return the fibers to their unswollen condition). An example cites the dyeing of a cellulose acetate fabric in an alcoholic solution of a red fluorescent dye of the

phenolphthalein class at 27°C. for 20 min., after which it is quickly flushed with cold water and dried.

Reference is made to Brit. P. 560,143 (H. Meyer—1944) describing "improved dyed articles" obtained by immersing the dyed goods in a methyl-umbelliferon solution. Similarly, Geigy's U. S. Pat. 2,473,475 (see col. 1, line 49-50 of the patent) proposes using optical bleaching agents for brightening during the dyeing and printing process. U. S. Pat. 2,463,264 (Ciba) discloses that fluorescence imparting agents have the effect of "improving, in the case of dyed material, the purity of the shade".

Thus it appears that combinations of dyeings with optical bleaching agents have been proposed heretofore. The main characteristic of the present patent is the specific dyeing method with fluorescent dyes in limited quantities on cellulose acetate according to the solvent method under controlled conditions. Adding noncolored fluorescent compounds may widely improve this effect.

CORRECTION

On page 5 of the January 8, 1951 issue, the patent number for the digest entitled "DYEING MACHINE — Goods Moved with Constant Speed" is incorrect. It should read U S Pat 2,513,309.

NEWS

• New Fabrics Conference (AATT) Set for the 28th

The American Association of Textile Technologists seeks to provide suggestions in the development of new fabrics for the armed forces through a full day "Conference on New Fabrics for the Armed Forces" to take place Wednesday, February 28 at the Hotel Commodore, New York.

In order to provide an exchange of views of some of the industry's leading technologists regarding fabrics now under study, the day will be divided into three phases. The morning session will be given over to a consideration of the apparel fabrics required by each service. After an industry lunch, there will follow an afternoon technical session at which new needs of the Air Force for filament fabrics will be discussed. Dr. Milton Harris, president of Harris Research Laboratories, will be chairman of the panel discussions of both technical sessions.

The morning session is scheduled for 9:30 and will start with a presentation of some of the new requirements of the services for fabrics and finishes. This will be presented by a group of men under the chairmanship of Dr Stephen J Kennedy, director of the Textile, Clothing & Footwear Section, Research & Development Branch of Military Planning Division of the Office of the Quartermaster General. Following this a panel will discuss the various requirements and bring out through discussion the ability of the industry to create cloths or finishes to supply the needs.

The luncheon will be under the chairmanship of the Association's new president, George Hotte of A M Tenney Associates, Inc. The speaker will be A E Buchanan, assistant general manager of the Rayon Department of E I du Pont de Nemours & Co, Inc.

At the afternoon session, the new requirements of the Air Force will be presented by a group of specialists from the Wright-Patterson Air Force Base, Dayton, Ohio. These will include C D Huxley, Chief of the Clothing Branch of the Aero-Medical Laboratory; J E Walker, Assistant Chief of the same laboratory; Major Richard Barnes, Parachute Branch, Equipment Laboratory and William A Corry, Chief of the Textile Unit, Air Material Command, U S Air Force. Following this there will be another discussion by a panel of technologists specially versed in related fields.

General chairman of the Conference is Stephen S Marks, *Daily News Record,* Other members include Leonard Little, E I du Pont de Nemours & Co, Inc; George Linton, Fashion Institute; Walter Scholer, American Viscose Corp; Irene Blunt, National Federation of Textiles: George Baxter, Bradford Dyeing Association; Joseph Hirsch, Cyril Johnson Woolen Mills; Gerard Lake, Pepperell Mfg Co; Bernice S Bronner, American Cyanamid Co; James Jonas, Pellissier, Jonas & Rivet, Inc; John Hagen, Callaway Mills, and Julian Jacobs, Textile Research Institute.

Participation in the conference, including luncheon, will be $8.50 and no arrangements will be made for partial attendance. Admission will be made by ticket only and in addition to individual admissions, textile firms may arrange for tables of ten. Reservations will be received by James Jonas, Room 6800, 350 Fifth Ave, New York 1, N Y, and checks should be made out to the AATT.

• Gsell to Head New Association

The newly-formed Association of Textile Screen Makers, Printers & Processors, Inc has elected Ernest A Gsell of the Gsell Textile Printing Corp president. Mr Gsell is also a director of the association, and, in accordance with the by-laws, will continue in that capacity for two years following completion of his one-year term as president.

Other officers elected at the group's first general meeting, held at the Hotel Martinique, New York, with about 30 firms present, were the following:

Vice-president—Keegan Yszdanian, U S Textile Screen Engraving Corp

Treasurer—Max Jacobs, York Textile Print Corp

Executive Secretary—Irving D Goodstein, attorney

Members of the Board—Henry Lutowski, Loyal Screen Print Co

Harold Straus,, Atlantic Textile Printing Co

Herman Figowy, Empire Screen Printing Co

Maxwell Blum, Bluco Printing Corp

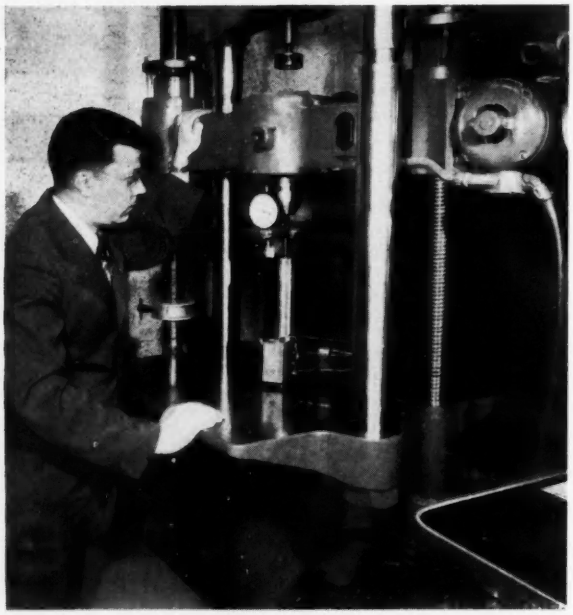
Albert Cluzel, Tavernon Photo Engraving Co

Alexis Thomas, Modern Steaming & Washing Co, Inc

David Schneider, City Screen Print Corp

All of the officers have been active on the organizational committee, which had set up the framework of the new group.

Two new firms have applied for membership along with the 24 charter members: Ciba Co and Ranel Textile Finishers.



NBS Compressibility Apparatus

Apparatus used by the National Bureau of Standards to study the compressive properties of high polymers. The polymeric specimen is immersed in a suitable pressure-transmitting liquid within the smooth bore of a thick-walled cylindrical bomb (center) of hardened steel. Pressure is then applied to force a tight-fitting piston into the bomb from above. This increases the hydrostatic pressure within, compressing the specimen. Depth of penetration of the piston is determined by reading the dial gage mounted on the ram which drives the piston into the bomb. Connections to a manganin pressure gage, which is mounted inside the bomb within the pressure-transmitting liquid, may be seen near the bottom of the cylinder.

• NBS Completes Polymer Compressibility Studies

In cooperation with the Carnegie Institution of Washington, the National Bureau of Standards has released information on the properties of polymers at high pressures (1,000 to 10,000 atmospheres). The compression experiments were carried out by C E Weir of the NBS*. Volume-pressure curves have been fitted to the experimental data, providing a basis for comparison of compressibilities for the synthetic plastics polyvinylidene chloride (Saran), polymonochlorotrifluoroethylene (Kel-F), polytetrafluoroethylene (Teflon), polyethylene, and a polyester (Selectron 5003); the raw synthetic oil-resistant rubbers Hycar OR-25, Hycar OR-15, Neoprene, and Thiokol ST; and the natural polymers cellulose and collagen (the principal constituent of leather). Several tanned leathers were also investigated.

The Bureau is investigating basic constants and properties of high polymers in order to learn more about their molecular structure and to interpret their behavior in the form of useful products. While the high-pressure apparatus employed in this work was designed primarily for use in the Bureau's investigation of leather shrinkage, it was found of excellent value for Mr Weir's study.

Inquiries as to test results should be addressed to the National Bureau of Standards, Technical Reports Section, Washington 25, D C.

* For further details, see "High-pressure Apparatus for Compressibility Studies and Its Application to Measurements in Leather and Collagen," C E Weir, *J Research NBS* 45, 463 (1950) RP 2160; and "Compressibility of Natural and Synthetic High Polymers at High Pressures," C E Weir, *J Research NBS* 46, (1951) RP 2192.

• Annual Meeting, SOCMA

At the twenty-ninth annual meeting of the Synthetic Organic Chemical Manufacturers Association of the U S, held on Tuesday, December 12th, 1950 at the Hotel Commodore, New York City, the following were elected officers for 1951:

President—Sidney C Moody, American Cyanamid Co

1st Vice-President—Cary R Wagner, General Aniline & Film Corp

2nd Vice-President—Paul K Lawrence, E I du Pont de Nemours & Co, Inc

Treasurer—Clayton S Shoemaker, Dow Chemical Company

Board of Governors—Class of 1953—Frederick Dehls, Benzol Products Co; Morton M Gruber, U S Industrial Chemicals, Inc

Dr August Merz and Dr Elvin H Killheffer, Past Presidents, were elected honorary members of the Board of Governors.

Following a reception and cocktail party, dinner was served with President Moody presiding. Speaker for the evening, as previously reported, was Lieutenant General Robert L Eichelberger who discussed the Far Eastern picture with particular reference to Japan.

There was a total of 330 registrants for the meeting.

• Grinnell's 100th Anniversary

Grinnell Corporation, Providence, Rhode Island, commemorated its 100th anniversary by publication of an attractive booklet entitled "One Hundred Years of Piping Progress: Grinnell—1850 to 1950." The booklet traces the growth of the corporation from a partnership between a pattern maker and carpenter formed in 1850 and later incorporated under the name of the Providence Steam and Gas Pipe Company to the present time. Frederick Grinnell bought an interest in the Providence firm and became its President in 1869. Early activities of the firm were in the fields of heating with exhaust steam from Corliss engines, water supply, construction and erection of plants for making gas from rosin, crude oil and coal, and installation of related piping. In 1878 rights were secured to manufacture and install the Parmelee automatic sprinkler and in 1881 Mr Grinnell patented an exceptionally sensitive automatic sprinkler. During the next ten years Grinnell sprinklers were installed in over 10,000 buildings and extinguished more than 1,000 incipient fires. In 1892 the Providence Steam and Gas Pipe Company was consolidated with the Neracher and Hill Sprinkler Company and the Automatic Fire Alarm and Extinguisher Company under the name of General Fire Extinguisher Company. The foundry of A Carpenter & Sons in Providence was purchased in 1905 and a new foundry and shops erected in Cranston R I which have been in operation since 1909.

Frank H Maynard succeeded Mr. Grinnell as President in 1906 following Mr Grinnell's death in 1905. In 1919 Grinnell Company of the Pacific was formed and Grinnell Company, Inc was chartered to act as a sales agency for General Fire Extinguisher Company. The Supply Sales Division was organized that same year for sale of the company's manufactured products and related products of others. Grinnell Company of Canada, Ltd was incorporated in 1914. By 1925 ten warehouses were in existence and there were

five manufacturing plants. Power piping became an important part of the company's business resulting in the formation of the Industrial Piping Division. In 1944 the name of the parent company was changed to Grinnell Corporation. Russell Grinnell became President in 1925. He died in 1948 and was succeeded by James D Fleming.

In 1921 the American Moistening Company was purchased. The Ontario Malleable Iron Company was purchased in 1928 and the Columbia Malleable Castings Corporation in 1931. Thirteen of the eighteen sales warehouses opened since 1925 are west of the Mississippi River.

Grinnell has acquired American rights to the Saunders Diaphragm Valve which meets many needs in handling special materials, including slurries. Throughout its first hundred years Grinnell has supplied equipment in the fields of heating, industrial piping and pipe suspension, fire protection, pipe fittings, valves and specialties, industrial humidification and evaporative cooling.

• Vitromar Gets Paterson Building

Vitromar Piece Dye Works, Hawthorne, N J, has acquired a one-story brick building at 192 Putnam Street, in an expansion move. The building, occupied by J Galli Dyeing Co until Jan 1, contains 26,000 square feet.

• Freedman Elected President of LTI New York Chapter Alumni

David Freedman, President of Nottingham Woolens, Inc, New York, was unanimously elected to the presidency of the New York Chapter of the Lowell Textile Institute Alumni Association at a meeting of the Chapter on January 17 in New York. Mr Freedman, a member of the class of '38, succeeds Arthur M Currier of Latta Currier Co. Chas A Whitehead, Howes Publishing Co, succeeds Irwin Smoler of Smoler Brothers in the post of secretary-treasurer.

Approximately 50 were in attendance to hear Lt Col Yancey H Knowles of the New York Quartermaster Procurement Agency. His talk was on "Thoughts of the Quartermaster Corps as to Its Relationship with and Dependency upon the Textile Industry." It centered chiefly on QM planning for textiles and their procurement.

Other speakers on the program included Prof John R Robertson of the LTI faculty and Prof A E Wells, Executive Secretary and Treasurer of the Alumni Association. Retiring President Currier acted as toastmaster.

• Price of Methyl Methacrylate Monomer Cut 18%

Effective January 1, Rohm & Haas Company reduced the price of methyl methacrylate monomer in carload quantities 8c per pound, from a ten-year level of 44.5c to 36.5c, or approximately 18 per cent.

The company has manufactured the product, one of the chief intermediates for its acrylic plastic, Plexiglas, for quite some time in addition to several other acrylate and methocrylate esters. It also offers these for sale in monomeric form.

Among the desirable qualities of the acrylic polymers and copolymers are their colorless transparency, oxidation resistance, and stability under outdoor weathering conditions. Their more permanent usage is in the manufacture of plastic sheets and molding powders (Plexiglas), viscosity index improvers and pourpoint depressants for lubricating oils (Acryloid), leather finishes (Primal), textile and paper finishes (Rhoplex and Rhotex), protective coatings for metal (Acryloid), and thickening agents for latices (Acrysol). In spite of the fact that their costs have been higher than some of the vinyl-based products, their usage has grown in applications where their properties offered advantages. It is pointed out by D S Frederick, Rohm & Haas vice-president, that it has long been recognized that if these materials could be produced more cheaply, they would be employed more widely.

• Hotte to Head AATT

Officers of the American Association of Textile Technologists have assumed office for the current year with George H Hotte of A M Tenney Associates in the president's post. Election was by letter ballot.

Walter E Scholer of American Viscose Corp was named first vice president and Erb M Ditton of Gotham Hosiery Mills, second vice president. Bernice S Bronner of the Textile Resin Department of American Cyanamid Co, secretary and Olen F Marks, Industrial Rayon Corp, treasurer, were reelected.

Elected as members of the board of governors for three years were: Bert I Bertelsen, Botany Mills, Inc; Gerald Lake, Pepperell Manufacturing Co and Charles H Ochsner, Burlington Mills Corp.

Board members who will serve two additional years and were not subject to election at this time are Leonard S Little, E I du Pont de Nemours & Co, Inc, and Miss Irene Blunt, National Federation of Textiles.

Governors who have one year more to serve are Ephraim Freedman, R H Macy & Co and Richard T Kropf, Belding Heminway Co, Inc.

Officers who retire are Dr George E Linton, Fashion Institute, president, and Stephen S Marks, *Daily News Record*, first vice president.

• Kelpie Process Meets QM Requirements for Sweaters

The "Kelpie" antishrink process of the S & M Dye Works, Inc, Philadelphia, Pa has passed stringent U S Quartermaster specifications for all wool sweaters, it is announced. "Kelpie," the first of its kind to pass the tests, is a continuous wet chlorination process for wool.

In making the announcemnt, Lindsey H Mason, S & M president stated that the company can now guarantee that the Kelpie process meets antishrink specifications when applied to all wool products including top, yarn, knitted cloth and hosiery.

• Stauffer Expands Chlorine Production

To further expand their chlorine production, the Stauffer Chemical Company is installing additional equipment at Niagara Falls in line with the recent enlargement of facilities at their Henderson, Nevada plant. A 50 per cent expansion was announced a year ago and it is revealed that that additional capacity will be ready in 50 to 80 days. The second expansion, completion of which is set for January 1, 1952 will reportedly bring total capacity to well over 100 tons daily. The Company Engineering Department is in charge of the project with the assistance of Singmaster and Breyer; local contractors will be used.

Company officials state that the substantial increase in the demand for chlorine, plus Staffer's increased production of carbon tetarchloride and other chlorinated products at Niagara Falls, led to the decision to go ahead.

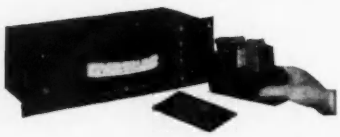
• Tanner Opens Charlotte Office

The Chas S Tanner Company, manufacturers and importers of starch, gum, dextrine and glue, has opened a Southern office in the Liberty Life Building in Charlotte, North Carolina. Karl H Inderfurth will direct this office as previously reported.

• San Francisco Branch Office, Du Pont

The Organic Chemicals Department of E I du Pont de Nemours & Co, Inc, announces that its San Francisco branch office is now located at 111 Sutter Street, Room 626, San Francisco 4, California. The telephone number is EXbrook 2-6230.

NEW PRODUCTS



Pictured above is the General Electric HP-3 Pyrometer Controller. (See page 73 of the January 22 issue for a discussion of GE's Pyrometer equipment.)

• Plastic Film Products

The Blossom Manufacturing Co, Inc, 915 Broadway, New York 10, N Y, is currently receiving requests from wet-processors for information relative to their line of plastic film products. The line includes barrel covers, barrel or carton liners, drum covers, pouches, drum liners, bags and envelopes.

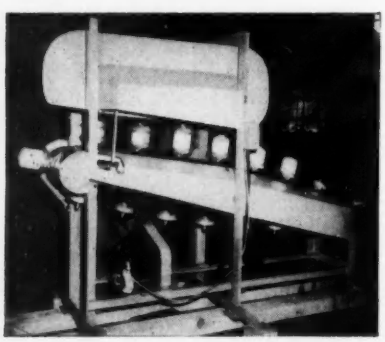
The film is said to be durable, strong, waterproof, lightweight, and resistant to most acids.

• Yarn Package Shaping Speeded

It is now reported possible to shape yarn packages for dyeing at a rate of 3,000 or more per hour with a new conveyor-type package shaping machine recently perfected by the Gaston County Dyeing Machine Company, Stanley, N C.

The yarn shaping operation, which is done preliminary to dyeing to relieve yarn tension and remove hard edges at both edges of yarn packages, is performed automatically by a series of continuously-moving cups arranged on a conveyor belt. This is said to be particularly helpful in dyeing critical shades. The rate at which packages may be shaped is limited only by the loading speed of the operator and tube damage is virtually eliminated, it is reported.

Available models of the machine will accommodate from 1 to 2-lb packages wound on ⅝ or 1⅜" dye tubes. Installation requires only plugging into a conventional lighting circuit.



Gaston County Conveyor-type Package Shaping Machine

• Atconil PW-35 for Print Washing

Following a study of the chemical properties necessary to bring about the removal of loose colors and gums in the print washing operation, Atlantic Chemical Company, Inc of Centredale, R I has come up with Atconil PW-35, a new product for print washing.

The product is said to create more brilliant prints, to promote thorough washing, to improve white grounds and discharge whites, and to thoroughly dissolve gums for better finishes. For the loose and unfixed color, it is claimed to be an excellent dispersing agent. Foaming properties of Atconil PW-35 have been adjusted so that a light foam forms on the surface of the bath. This reportedly prevents scum formation, and also gives an indication of the condition of the scouring liquor.

Atco recommends the product's use in a .1% concentration at temperatures ranging from 115° F to to the boil. Further information and trial samples are available from the manufacturer.

• Reilly 4-Vinylpyridine

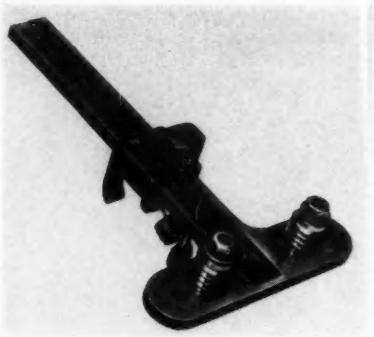
Reilly Tar & Chemical Corp, Indianapolis, Ind has announced the availability, in pilot plant quantities, of Reilly 4-Vinylpyridine, a chemical cousin to the coal tar chemical 2-Vinylpyridine.

In the laboratory, numerous high melting point solids are reported to have been produced through polymerization. Among them are: 4-Polyvinylpyridine, 4-Vinylpyridine-Styrene Copolymer, 4-Pyridyl-Ethyl-Sulfides, 4-Pyridylethyl Sulfonic Acid, 4-Pyridylethyl Quinolinium Chloride, 4-Pyridylethyl-Dimethyl-Phenyl-Ammonium Chloride, 4-Pyridyl-Ethyl Amines, 4-Cyclohexenyl Pyridine, 4-Pyridylethyl Ethers, 4-(2-Nitroethyl) Pyridine.

Samples and technical information on the product are available.

• Hand Serrating Tool

With the effectiveness of joints depending considerably upon the quality of pipe serrations, National Carbon Division of the Union Carbide and Carbon Corporation, 30 E 42nd St, New York 17, N. Y has come out with an improved hand serrating tool. Type FC Flexible Couplings are used in fitting National's "Karbate" Brand Impervious Graphite pipe, which requires strong, flexible joints.



National Carbon Hand Serrating Tool

The tool is reported to be simple, rugged in design and easy to use, providing an advantage in facilitating assembly of "Karbate" pipe on the job site in a minimum of time. Pipe sizes from 1" to 6" inclusive may be serrated.

Details of the tool and the accepted method of serrating may be obtained by writing to the National Carbon Division. Ask for *Catalog Section S-7060.*

GS No. 11 Carboy Tilter

The General Scientific Equipment Co, 2700 W Huntingdon Street, Philadelphia 32, Pa offers the GS #11 Carboy Tilter with an air vent pouring spout for $24.95. The spout, made of acid-resistant rubber and plastic tubing, insures a smooth flow of acid or other liquids without spurts or splashes to provide an easier, faster and safer method of pouring. Its flow capacity is listed at 5 gals/min.

The supporting members of the tilter are of structural steel with welded and riveted construction.

G-S "Safetee-Flo"

PERSONNEL

Raymond C Gaugler

RAYMOND C GAUGLER, 58, was elected President of the American Cyanamid Company at a meeting of the Board of Directors on Friday, January 5, succeeding the late William B Bell. Mr Gaugler has been a Director of the company since 1929 and has served as executive vice-president since his appointment to that position on October 23, 1947. He is also a director of several companies associated with ACC including Jefferson Chemical Company, Inc (jointly owned with the Texas Company), Southern Alkali Corporation, Southern Minerals Corporation, and Southern Pipeline Corporation, (all jointly owned with the Pittsburgh Plate Glass Company) as well as Cyanamid's principal subsidiaries (North American Cyanamid, Ltd, Chemical Construction Corporation, and Davis & Geck, Inc).

Before joining the Cyanamid organization, Mr Gaugler was with the United States Aluminum Company in New Kensington, Pennsylvania and the Northern Aluminum Company in Shawinigan Falls, Canada. Associating himself with the Cyanamid organization in 1917 as a member of the accounting department, he progressed through positions of assistant treasurer and comptroller, and was appointed treasurer on July 1, 1929. In 1939 Mr Gaugler was promoted to vice-president in charge of finances, a position which he occupied until his appointment as executive vice-president.

THOMAS L PERKINS, Perkins, Daniels & Perkins, 30 Rockefeller Plaza, New York, was elected a director to fill the vacancy created by the death of Mr Bell.

With his appointment to the Textile Fiber Research Group at the Stamford, Conn Research Laboratories of the American Cyanamid Company, BERNARD W CROWE will be concerned with the evaluation and development of the textile properties of synthetic fibers for use in spun yarn and filament yarn fabrics. His former associations were with George Royle and Co, Philadelphia, Callaway Mills, La Grange, Ga and Johnston Mill, Johnston, S C.

C V MARTIN has been appointed assistant director of purchases in charge of priorities and material expediting for The Davison Chemical Corp, it has been made known by M G Geiger, executive vice-president.

E F Drew & Co, Inc has appointed J P REDSTON as sales manager of the Textile Chemicals Department. Mr Redston, a past president of the CATCC, was formerly sales manager of the company's Specialty Oils Division. Educated in England, Mr Redston has been with various Canadian companies, including Dominion Silk Dyeing & Finishing Co; Belding-Corticelli, Ltd; Canadian Analine & Extract Co, and Dye & Chemical Co of Canada.

In his new capacity, Mr Redston will supervise sales and service activities for the full line, including oils, lubricants, synthetic detergents, wetting and emulsifying agents and other specialties.

J P Redston

ROBERT H BAILEY, SR, chairman of the Board of United Dye & Chemical Corporation, has been elected chairman of the Board of Lowell Adams Factors Corp. Mr Bailey is also chairman of the board of American Dyewood Company, president of United Sanitary Corporation and a director of the First National Bank of Farmingdale, Long Island.

ERNEST HACKWITZ, has been elected a director of United Dye and Chemical Corporation replacing CLIFTON S THOMSON who has resigned. Mr. Hackwitz, president of the First National Bank of Farmingdale, L I, is also a director of United Sanitary Corporation, a subsidiary of United Dye & Chemical.

F F Jacobs

Ciba Company Inc announces the appointment of F F JACOBS as director of research and development, with headquarters in New York. Mr Jacobs comes to Ciba from the Aspinook Corporation, where he held the position of technical director. For many years prior to this he was a printing specialist with the General Dyestuff Corporation.

HAROLD NAIDUS will supervise the expanding chemical research program of the American Polymer Corp, Peabody, Mass in his new role of Director of Research.

MAX POTASH has been appointed a Chief Engineer with APC and will be in charge of process development and design.

WALTER L RIPPETEAU has been appointed manager of the organic chemical sales department, Michigan Alkali Division, Wyandotte Chemicals Corporation. Following service with the Phillips Petroleum Company in the respective capacities of research engineer and technical field representative in the Chemical Products Division, Mr Rippeteau joined Wyandotte as a technical field representative in the Research and Development Division. He assumed the position of manager in the market development department in 1949.

Walter L Rippeteau

THOMAS A MARTONE, a section manager in the dyestuffs sales division of du Pont's organic chemicals department, retired recently after a career of 32 years with the company. A specialist in the manufacturing of pigments and dyestuffs, he was particularly well known to the carbon paper and dry color industries for his technical assistance and experience in the development of duplicating papers.

Joining du Pont in 1918 as an analytical chemist at the company's Deepwater Point plant, he was transferred to Wilmington in 1941.

DONALD F DEAKIN has joined the Atlas Mineral Products Company, Mertztown, Pa as water and sewers products director.

NEWTON O DUNCAN, JR has been assigned to Atlas' Houston office.

Adrian S Price

ADRIAN S PRICE has been named Advertising and Public Relations Director for the Dexter Chemical Corporation to integrate their promotion and publicity activities. Mr Price was formerly assistant advertising-sales promotion manager for Burndy Engineering Company, electrical manufacturers. Prior to that he had operated his own agency and consultant service.

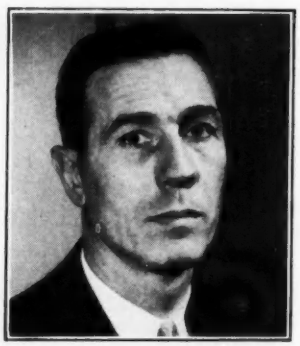
D E Douty, Chairman of the Board of United States Testing Company, Inc, Hoboken, N J, recently announced the appointment of HOWARD S BUNN and JAMES A GOLDSMITH, JR to the Board of Directors of the Company. Mr Bunn is Vice-President of both the Bakelite division and Carbide and Carbon Chemicals Division of Union Carbide and Carbon Corporation, and has been with this firm for the past 29 years. Mr Goldsmith, who was recently appointed President of Hess, Goldsmith & Company, Inc of New York, has been associated with U S Testing for 26 years.

Wilbur B Pings

DR WILBUR B PINGS has been appointed by Witco Chemical Company as director of research with headquarters at 6200 West 51st Street, Chicago, Illinois. Dr Pings has had extensive experience in planning and directing research, having been employed as chemist at the E I du Pont de Nemours experimental station at Wilmington, Del, for nine years, and more lately as research executive with Arthur D Little, Inc, Cambridge, Mass and Godfrey L Cabot, Inc, Boston.

Following the return of WILLIAM HOWSON from an extended vacation in Florida and his appointment as production consultant to the president, EARL CLIFFORD has been appointed executive manager of the Pontiac Finishing Plant of Fruit of the Loom, Inc at Pontiac, Rhode Island. EDGERTON BLOOMER has been made production manager.

EDWARD J SHERIDAN has been named general manager of the pigments division by Sun Chemical Corp. Mr Sheridan left his own business to join Sun in 1946. A chemical engineer, he has been active in color and allied fields the past 20 years.



Weldon G Helmus

Fairlawn Finishing Co has been named head of the dyers and finishers division of the textile section of the 1951 Red Cross fund campaign of Greater New York.

OBITUARY

HUGH J HORNE

HUGH J HORNE, dyer and chemist for the Roanoke Mills Company, Roanoke Rapids, North Carolina, and a member of the Piedmont Section, AATCC, died in Baltimore, Maryland, as a result of a heart attack on November 14. Mr Horne, age 51, was born in Farmington, North Carolina, and attended Emory & Henry College. He received his Masters degree from Tulane University. Burial was in Farmington, North Carolina.

TECHNICAL LITERATURE

Instrumentation Data Sheet No. 8.1-38 —"Tachometers for the Textile Industry"; Minneapolis-Honeywell Regulator Company, Brown Instruments Division, Wayne and Windrim Aves, Philadelphia 44, Pa (Refer to Station 40).—This report is an illustrated sheet on the use of the Brown recording *ElectroniK* potentiometer in conjunction with a Tachometer Generator to plot machine speeds for time study and processing analysis. Also included are sections on equipment specifications and applications.

Technical Bulletin 25 — Automatic Emulsifier for Liquid Rosin Size—Industrial Chemicals Division, American Cyanamid Company—General engineering data, details on how the unit operates and flow diagrams. The emulsifier is a compact, pre-assembled unit connected to tank car rosin-size storage facilities and has a single discharge line to one dilute emulsion tank. Dimensions are 5' x 4' x 6'. The machine delivers a fine particle size emulsion with the solids content reported accurate to ±0.1%. It will handle up to 12 tank cars per month, it is stated.

"Manual of Laboratory Safety"—Fisher Scientific Co, 717 Forbes St, Pittsburgh 19, Pa—Newly revised; 40 pages. The original material of this manual, which has been translated into several foreign languages, has been brought up-to-date by the inclusion of recently developed data, techniques and equipment. It should prove useful in the implementation of laboratory safety endings.

Corrosion Proof Linings Bulletin 4-1 —Atlas Mineral Products Company, 42 Walnut Street, Mertztown, Pa—Describes Atlas' complete line of corrosion proof linings, including sheet, solution, dispersion or misc linings as well as brick sheathings.

Traditional Blue ...BY MIRON

Accustomed as we are to thinking of blue serge in respect to the boys in the high school graduating class—we're eager to welcome this trim and feminine suit of Miron worsted.

Miron, like so many other mills which "think ahead", calls upon Sandoz for various dyestuffs to meet their high standard of quality. Among the colors selected are the Sandoz METOMEGA chrome colors which they use to insure the long-lasting rich appearance of such fabrics...for METOMEGA means maximum resistance to light and other hazards of wear.

These rugged colors also hold their shade during severe mill treatments like fulling, carbonizing and decatizing. They reduce boiling time by as much as 50% and speed up formula-checking. And they have the unusual property of dyeing loose wool "solid" or free from "tippiness".

And for *any* chrome, acid or direct dyes . . . or auxiliary chemicals . . . for both natural and synthetic fibres ...be guided by the successful "color achievements" you see in these Sandoz advertisements.

DIRECT-DYE COTTON AND RAYON WITH CUPROFIX FOR WASH FASTNESS

New CUPROFIX colors and after-treatment give fastness to washing, light, etc., that formerly required more expensive vat dyeing. Write for booklet on CUPROFIX, already adopted by dozens of mills.

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SANDOZ thinks ahead with textiles

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February 5, 1

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Here are 7 reasons why TRENTWELD is better

1. Largest variety of sizes—4½" to 30" inclusive
2. Finished tubing... machine-formed, machine-welded, machine-sized for uniformity
3. Made in a *tube* mill by *tube* experts
4. Made from tested cold rolled sheets . . . completely fused into finished tubing *without* added rod metal
5. No zone of weakness for corrosion to attack
6. Uniform section, metallurgically correct
7. Available for fabrication with any fittings

Trentweld Large Diameter (4½" to 30") Stainless Steel Tubing should not be compared to rolled up and hand welded sheets: Trentweld tubing is machine formed and machine welded without metal added. The weld is fused to the parent metal by an exclusive Trent development. That's what makes the difference, and that's why more and more fabricators, designers and manufacturers of all types of processing equipment are turning to Trent for their tubing requirements.

When you do business with Trent, you get top quality tubing PLUS engineering assistance to put stainless tubing to work in your application . . . better! Write for Trentweld Data Bulletin and tell us the application you have in mind.

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Subsidiary of Crucible Steel Company of America
General offices and plant: East Troy, Wisconsin
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Serving the textile printing, finishing and dyeing industry with a complete range of quality detergents, finishes, printing gums, penetrants, softeners and specialties. Complete analytical and practical laboratory facilities.

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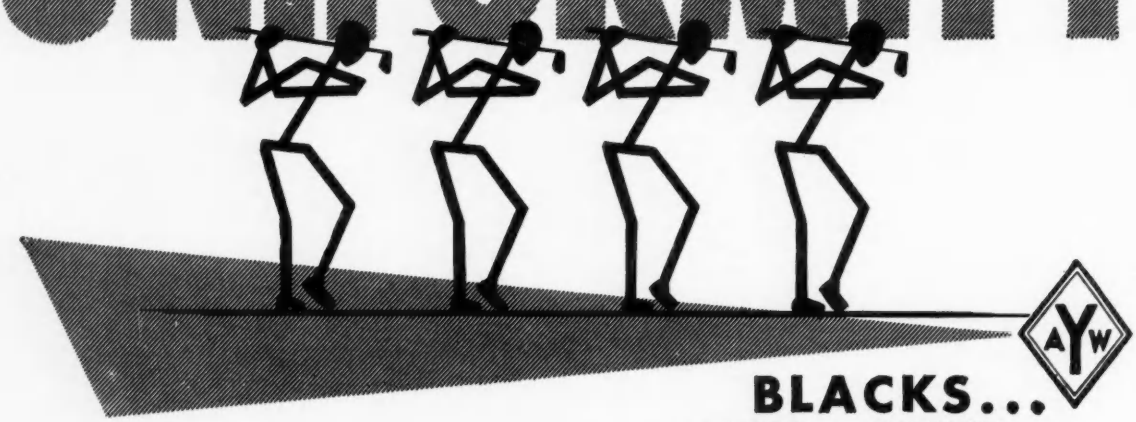
UNIFORMITY



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• ACID • DIRECT •
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Consult your local dyestuff distributors for information and samples. Shipments can be made from their convenient stocks or from our Baltimore and Paterson warehouses.

YOUNG ANILINE WORKS, INC.

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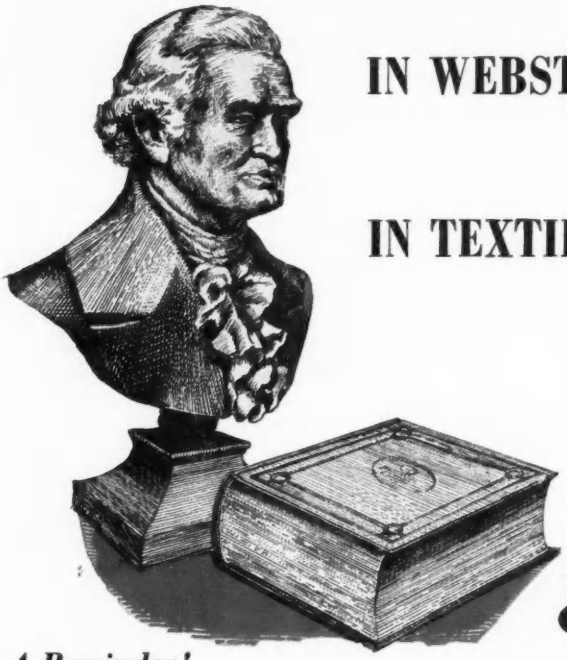
Paterson Office
50 East 13th Street, Paterson, N. J.



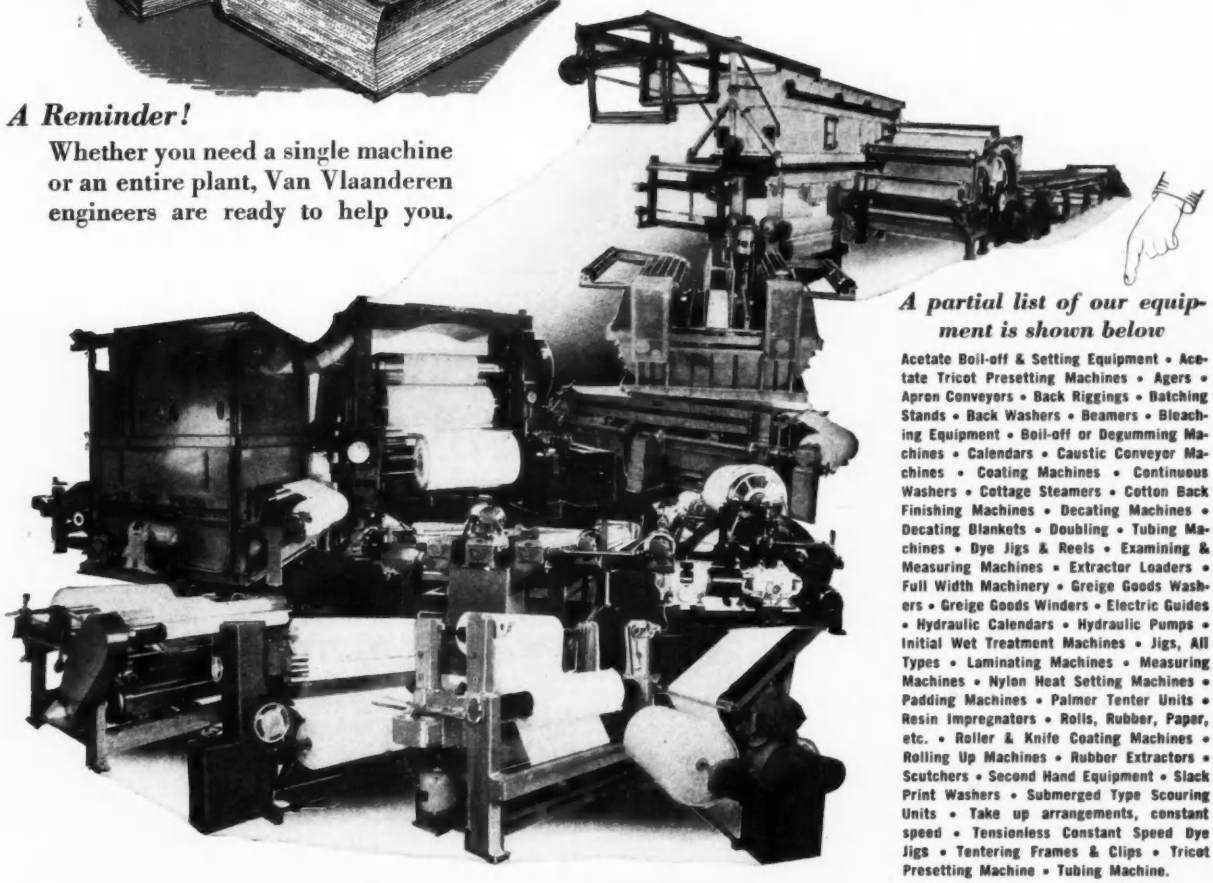
IN WEBSTER'S "VAN" means . . . those in the lead.

IN TEXTILES, "Van Vlaanderen" means the leader in dyeing and finishing equipment.

For nearly fifty years Van Vlaanderen has always been a step ahead—in design, in workmanship and in service.

A Reminder!

Whether you need a single machine or an entire plant, Van Vlaanderen engineers are ready to help you.



A partial list of our equipment is shown below

Acetate Boil-off & Setting Equipment • Acetate Tricot Presetting Machines • Agers • Apron Conveyors • Back Riggings • Batching Stands • Back Washers • Beamers • Bleaching Equipment • Boil-off or Degumming Machines • Calendars • Caustic Conveyor Machines • Coating Machines • Continuous Washers • Cottage Steamers • Cotton Back Finishing Machines • Decating Machines • Decating Blankets • Doubling • Tubing Machines • Dye Jigs & Reels • Examining & Measuring Machines • Extractor Loaders • Full Width Machinery • Greige Goods Washers • Greige Goods Winders • Electric Guides • Hydraulic Calendars • Hydraulic Pumps • Initial Wet Treatment Machines • Jigs, All Types • Laminating Machines • Measuring Machines • Nylon Heat Setting Machines • Padding Machines • Palmer Tenter Units • Resin Impregnaters • Rolls, Rubber, Paper, etc. • Roller & Knife Coating Machines • Rolling Up Machines • Rubber Extractors • Scutchers • Second Hand Equipment • Slack Print Washers • Submerged Type Scouring Units • Take up arrangements, constant speed • Tensionless Constant Speed Dye Jigs • Tentering Frames & Clips • Tricot Presetting Machine • Tubing Machine.

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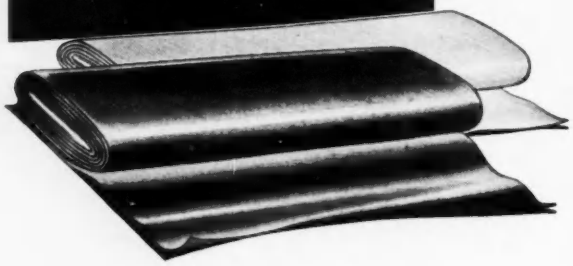
World's largest manufacturer of machines for processing modern fabrics

"VIRGINIA" SODIUM HYDRO DOES IT!



One Step Toward Uniform Shades

If you have been looking for a better hydro to use with your vat dyes, why not switch to "Virginia" Sodium Hydrosulphite? Its strength and uniformity from drum to drum, and stability in the bath, could make life easier in your dye house and cloth room.

Leading textile manufacturers and processors have approved "Virginia" Hydro for their operations. They depend upon its unvarying high quality and performance. They know that it is unsurpassed as a reducing and stripping agent.

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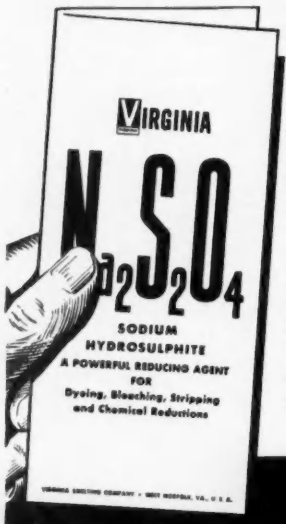

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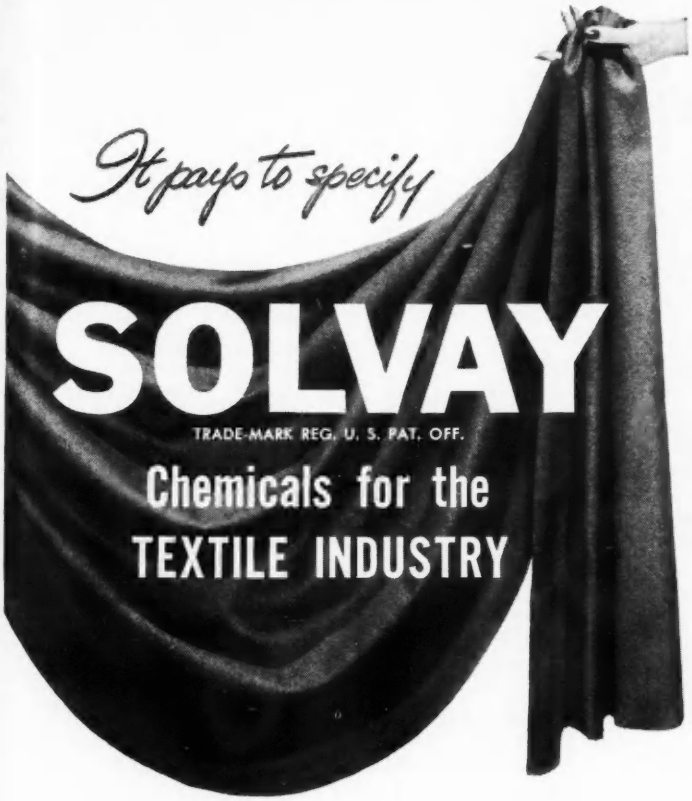

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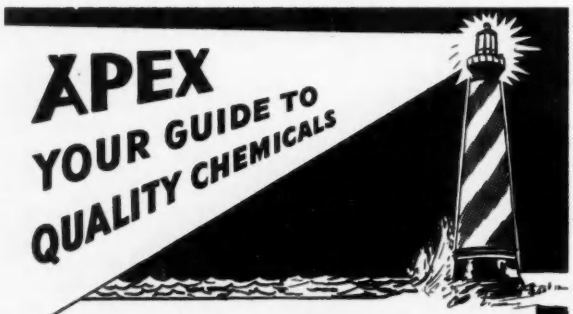

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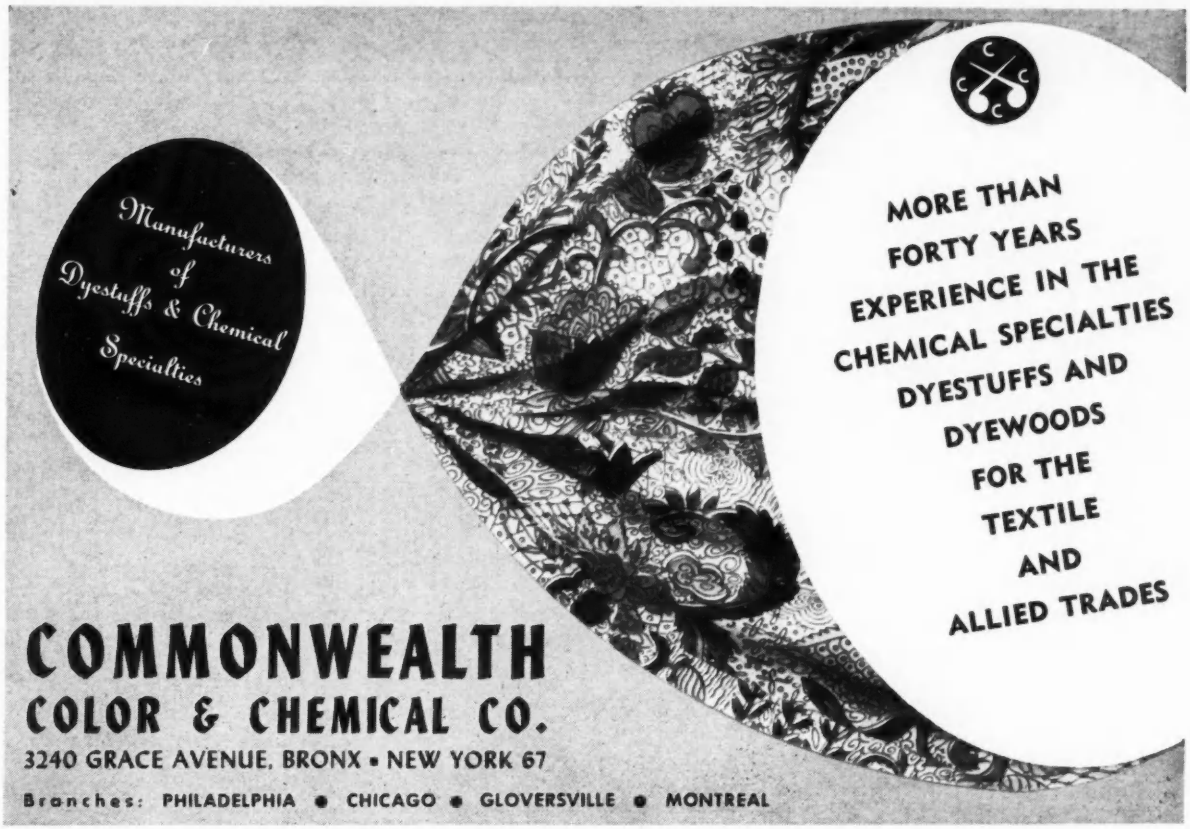
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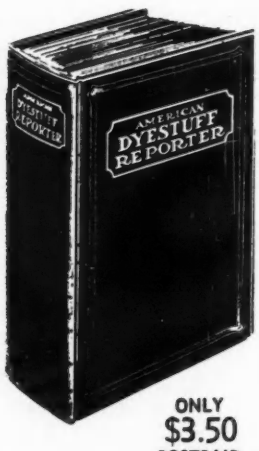

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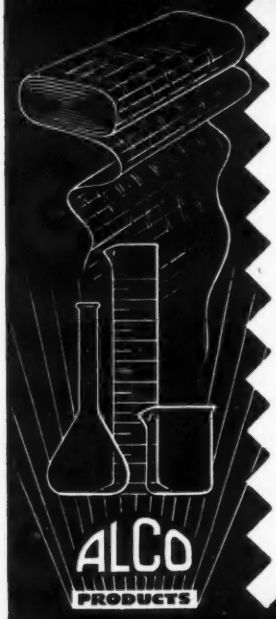

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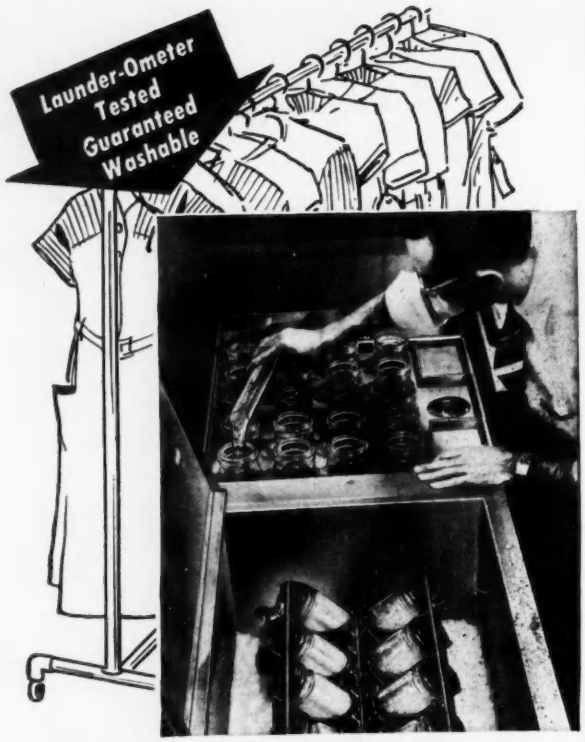

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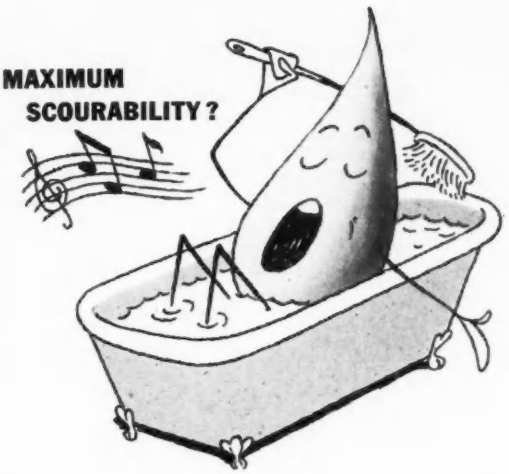

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Ethanolamines
CELLOSIZE Hydroxyethyl Cellulose
KROMFAX Solvent
Ethyl Acetate
Acetic Anhydride
TERGITOL Surface Active Agents
Ethylene Amines
CARBOWAX Compounds
FLEXOL Plasticizers
Glyoxal
UCON Textile Lubricants

CARBIDE AND CARBON CHEMICALS DIVISION

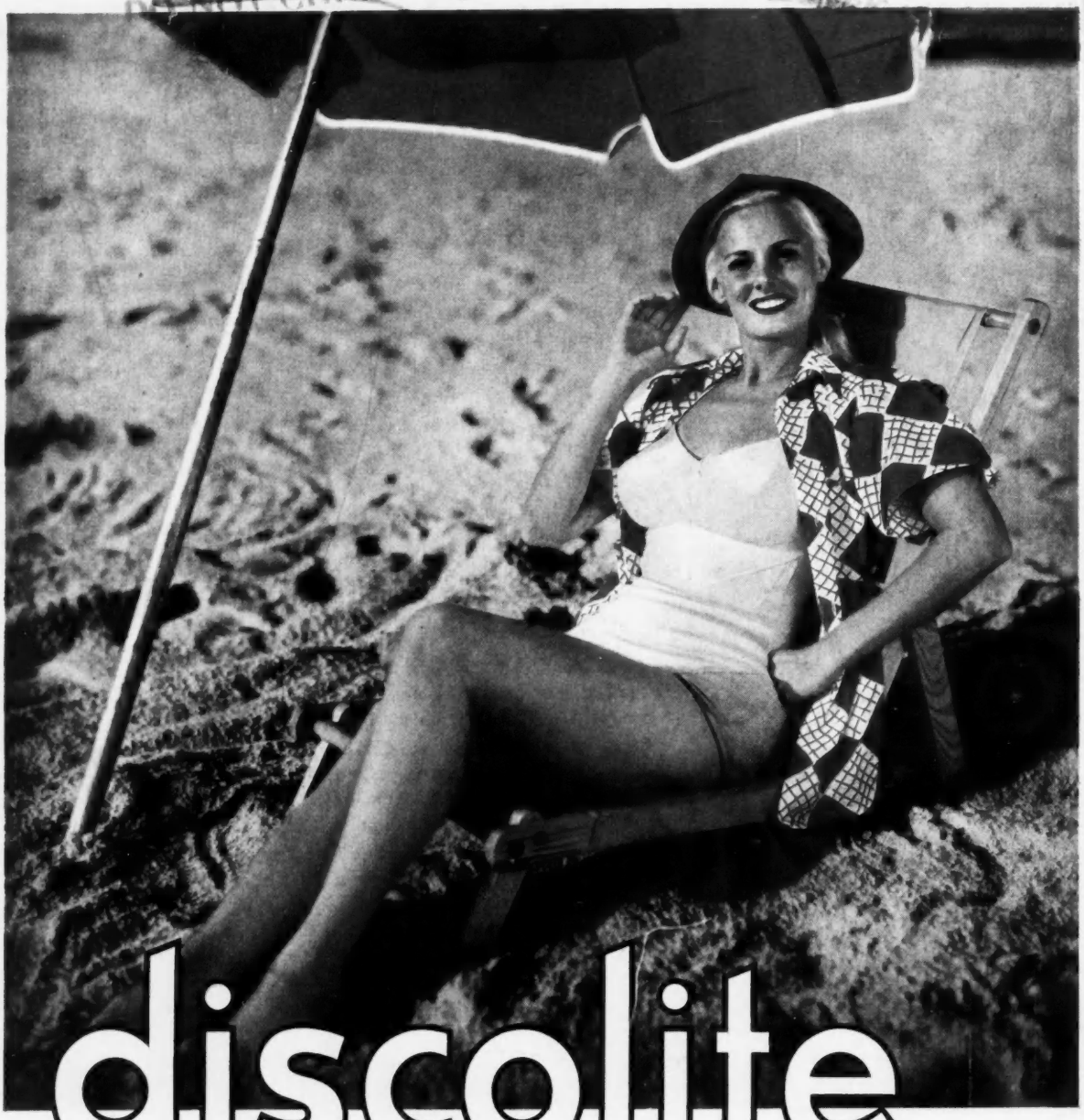
Union Carbide and Carbon Corporation

30 East 42nd Street NEC New York 17, N. Y.

Offices in Principal Cities

In Canada:
Carbide and Carbon Chemicals, Limited, Toronto

DO NOT CIRCULATE



discolite©

Concentrated Sodium Sulphoxylate Formaldehyde

Stable at high temperatures, Discolite is most effective as a reducing agent to effect solubilization of the vat color . . . is highly useful when the process calls for the reducing agent to be dried into the fabric as in printing without loss of its reducing properties.

Royce

CHEMICAL COMPANY • CARLTON HILL, NEW JERSEY

Manufacturers of Chemicals for the Textile Industry

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